# Dell Precision™ Workstation 650 and Dell Precision Workstation 450 Service Manual



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Models: WML and WMF

October 2002 Rev. A00

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# Battery

**Dell Precision™ Workstation 650 and Dell Precision Workstation 450 Service Manual**

**CAUTION: Before you begin this procedure, follow the safety instructions in the *System Information Guide*.**

A coin-cell battery maintains computer configuration, date, and time information. The battery can last several years.

The battery may need replacing if you have repeatedly reset the time and date information after turning on the computer or if one of the following messages appears:

```
Time-of-day not set - please run SETUP program
```

or

```
Invalid configuration information -
please run SETUP program
```

or

```
Strike the F1 key to continue,
F2 to run the setup utility
```

To determine whether you need to replace the battery, reenter the time and date in system setup and exit the program to save the information. Turn off your computer and disconnect it from the electrical outlet for a few hours; then reconnect the computer, turn it on, and enter system setup. If the date and time are not correct in system setup, replace the battery.

You can operate your computer without a battery; however, without a battery, the configuration information is erased if the computer is turned off or unplugged from the electrical outlet. In this case, you must enter system setup and reset the configuration options.

**CAUTION: A new battery can explode if it is incorrectly installed. Replace the battery only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.**

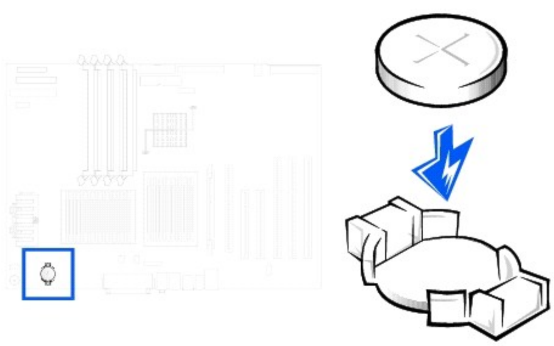
**NOTE:** If you have not already done so, make a copy of your configuration information, found in system setup.

To replace the battery:

1. Locate the battery socket. For the Dell Precision 450 computer, see "System Board Components" or for the Dell Precision 650 computer, see "System Board Components" or see the system board label inside your computer.

**NOTICE:** If you pry the battery out of its socket with a blunt object, be careful not to touch the system board with the object. Ensure that the object is inserted between the battery and the socket before you attempt to pry out the battery. Otherwise, you may damage the system board by prying off the socket or by breaking circuit traces on the system board.

2. Remove the battery by carefully prying it out of its socket with your fingers or with a blunt, nonconducting object such as a plastic screwdriver.
3. Insert the new battery into the socket with the side labeled "+" facing up, and snap the battery into place.



**NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

4. Close the computer cover, and plug your computer and devices into electrical outlets.
5. Enter system setup and restore the settings.
6. Properly dispose of the old battery. For more information see your *System Information Guide*.

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# Before You Begin

**Dell Precision™ Workstation 650 and Dell Precision Workstation 450 Service Manual**



This section provides procedures for removing and replacing the components, assemblies, and subassemblies in the Dell Precision™ 450 computer and Dell Precision 650 computer. Unless otherwise noted, each procedure assumes that the following conditions exist:

- You have performed the steps in "Precautionary Measures."
- You have read the safety information in your *System Information Guide.*
- You have opened the computer cover.

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## Recommended Tools

Your computer is primarily a tool-less one, but certain procedures (such as removing the heat-sink blower or the control panel) require the use of one or more of the following tools:

- Small flat-blade screwdriver.
- #1 and #2 Phillips-head screwdrivers.
- An 8-inch, #2 Phillips-head screwdriver.

It is recommended that you use a wrist grounding strap as explained in "Precautionary Measures."

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## Precautionary Measures

Use the following safety guidelines to help protect your computer from potential damage and to ensure your own personal safety.

**CAUTION: Before you begin any of the procedures in this section, follow the safety instructions in the *System Information Guide*.**

**CAUTION: Do not attempt to service the computer yourself, except as explained in your online Dell™ documentation or in instructions otherwise provided to you by Dell. Always follow installation and service instructions closely.**

**NOTICE:** To help avoid possible damage to the system board, wait 5 seconds (or wait until the standby light is extinguished) after turning off the computer and unplugging the power cable before removing a component from the system board or disconnecting a device from the computer.

Before you start to work on the computer, perform the following steps in the sequence listed:

1. Shut down the computer through the **Start** menu.
2. Ensure that your computer and attached devices are turned off. If your computer and attached devices did not automatically turn off when you shut down your computer, turn them off now.

**NOTICE:** To disconnect a network cable, first unplug the cable from your computer and then unplug it from the network wall jack.

3. Disconnect any telephone or telecommunication lines from the computer.
4. Disconnect your computer and all attached devices from electrical outlets, and then press the power button to ground the system board.

In addition, take note of these safety guidelines when appropriate:

- When you disconnect a cable, pull on its connector or on its strain-relief loop, not on the cable itself. Some cables have a connector with locking tabs; if you are disconnecting this type of cable, press in on the locking tabs before disconnecting the cable. As you pull connectors apart, keep them evenly aligned to avoid bending any connector pins. Also, before you connect a cable, ensure that both connectors are correctly oriented and aligned.
- Handle components and cards with care. Do not touch the components or contacts on a card. Hold a card by its edges or by its metal mounting bracket. Hold a component such as a microprocessor chip by its edges, not by its pins.

---

## Protecting Against Electrostatic Discharge

Static electricity can harm delicate components inside your computer. To prevent static damage, discharge static electricity from your body before you touch any of your computer's electronic components, such as the microprocessor. You can do so by touching an unpainted metal surface on the computer chassis.

As you continue to work inside the computer, periodically touch an unpainted metal surface to remove any static charge your body may have accumulated.

You can also take the following steps to prevent damage from electrostatic discharge (ESD):

- When unpacking a static-sensitive component from its shipping carton, do not remove the component from the antistatic packing material until you are ready to install the component in your computer. Just before unwrapping the antistatic packaging, be sure to discharge static electricity from your body.

- When transporting a sensitive component, first place it in an antistatic container or packaging.
- Handle all sensitive components in a static-safe area. If possible, use antistatic floor pads and workbench pads.

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# Cards

**Dell Precision™ Workstation 650 and Dell Precision Workstation 450 Service Manual**



**CAUTION: Before you begin any of the procedures in this section, follow the safety instructions in the *System Information Guide*.**

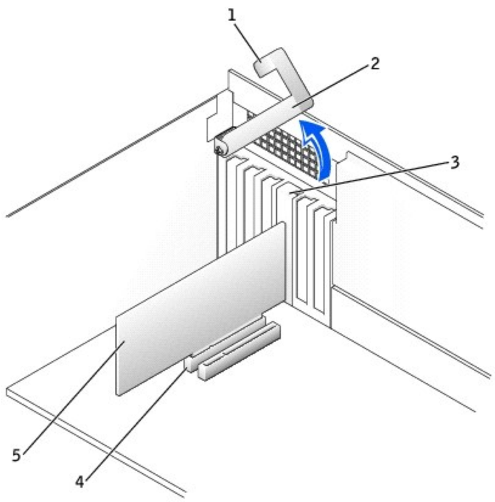
Your Dell™ computer provides slots for PCI/PCI-X and AGP cards. For more information, see "Specifications" in your *User's Guide* or the system board components illustration for your computer.

**NOTE:** To meet PC99 requirements, your Dell computer uses only PCI slots. ISA cards are not supported.

If you are installing or replacing a card, follow the procedures in the next section. If you are removing but not replacing a card, see "Removing a Card."

## Installing a Card

1. Press the lever on the card retention arm and raise the retention arm.




| | |
|---|---|
| **1** | lever |
| **2** | retention arm |
| **3** | card bracket |
| **4** | card connector |
| **5** | card |

2. If you are installing a new card, remove the filler bracket to create a card-slot opening. Then continue with step 4.
3. If you are replacing a card that is already installed in the computer, remove the card.

   If necessary, disconnect any cables connected to the card. Grasp the card by its top corners, and ease it out of its connector.

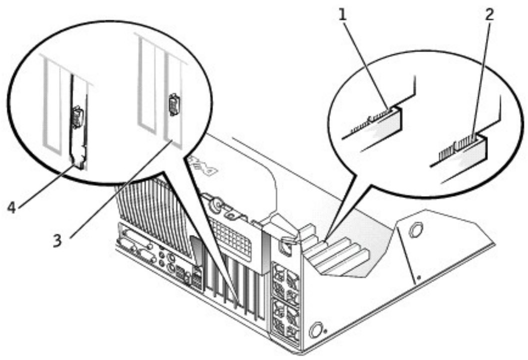
4. Prepare the card for installation.

   See the documentation that came with the card for information on configuring the card, making internal connections, or otherwise customizing it for your computer.

**CAUTION: Some network connectors automatically start the computer when they are connected to a network. To guard against electrical shock, be sure to unplug your computer from its electrical outlet before installing any cards. Verify that the standby power light on the system board is off. To locate this light, see the system board illustration (for the Dell Precision 450 computer, see "System Board Components" or for the Dell Precision 650 computer, see "System Board Components" ).**

5. Place the card in the connector and press down firmly. Ensure that the card is fully seated in the slot.

   If the card is full-length, insert the end of the card into the card guide bracket as you lower the card toward its connector on the system board. Insert the card firmly into the card connector on the system board.

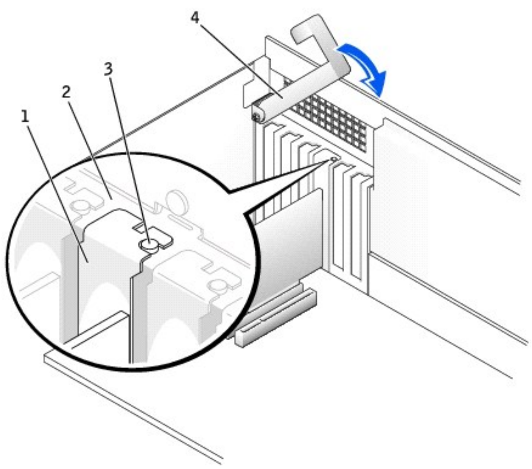



| | |
|---|---|
| **1** | fully seated card |
| **2** | not fully seated card |
| **3** | bracket within slot |
| **4** | bracket caught outside of slot |

6. Before you lower the retention arm, ensure that:

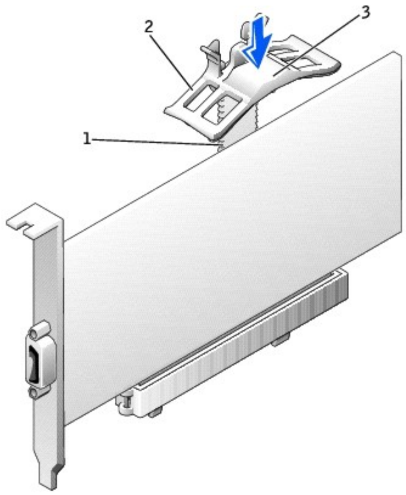
   - The tops of all cards and filler brackets are flush with the alignment bar.
   - The notch in the top of the card or filler bracket fits around the alignment guide.

   Press the arm into place, securing the card(s) in the computer.




| | |
|---|---|
| **1** | filler bracket |
| **2** | alignment bar |
| **3** | alignment guide |
| **4** | retention arm |

7. If you are replacing an AGP card, align the AGP card guide with the base and press down on the indentation until the guide stops at the top of the AGP card.




| | |
|---|---|
| 1 | base |
| 2 | AGP retention spring |
| 3 | indentation |

**NOTICE:** Do not route card cables over or behind the cards. Cables routed over the cards can prevent the computer cover from closing properly or cause damage to the equipment.

8. Connect any cables that should be attached to the card.

   See the documentation for the card for information about the card's cable connections.

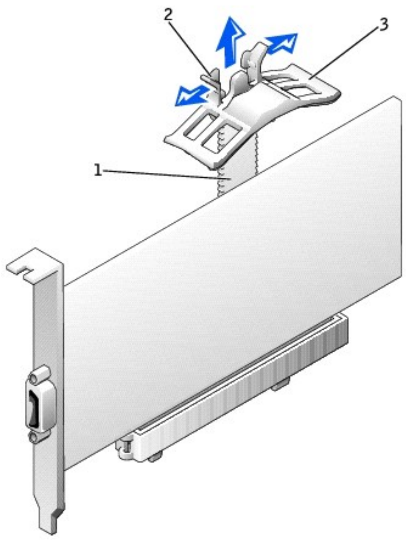
**NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

9. Close the computer cover, reconnect the computer and devices to electrical outlets, and turn them on.
10. If you installed a sound card:
    a. Enter system setup, select **Integrated Devices**, and then change the setting for **Sound** to **Off**.
    b. Connect external audio devices to the sound card's connectors. Do not connect external audio devices to the microphone, speaker/headphone, or line-in connectors on the back panel.
11. If you installed an add-in network connector:
    a. Enter system setup, select **Integrated Devices**, and then change the setting for **Network Interface Card** to **Off**.
    b. Connect the network cable to the add-in network connector's connectors. Do not connect the network cable to the integrated connector on the back panel.
12. Install any drivers required for the card as described in the card documentation.

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## Removing a Card

1. Press the lever on the card retention arm and raise the retention arm (see "Installing a Card").
2. If you are removing an AGP card, press out on the release tabs and pull the AGP card guide up and off of the base.




| | |
|---|---|
| 1 | base |
| 2 | release tabs (2) |
| 3 | AGP retention spring |

3. If necessary, disconnect any cables connected to the card.

4. Grasp the card by its top corners, and ease it out of its connector.

5. If you are removing the card permanently, install a filler bracket in the empty card-slot opening.

   If you need a filler bracket, contact Dell.

**NOTE:** Installing filler brackets over empty card-slot openings is necessary to maintain FCC certification of the computer. The brackets also keep dust and dirt out of your computer.

6. Lower the retention arm and press it into place, securing the card(s) in the computer.

**NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

7. Close the computer cover, reconnect the computer and devices to electrical outlets, and turn them on.

8. Remove the card's driver from the operating system.

9. If you removed a sound card:

   a. Enter system setup, select **Integrated Devices**, and then change the setting for **Sound** to **On**.

   b. Connect external audio devices to the audio connectors on the computer back panel.

10. If you removed an add-in network connector, enter system setup, select **Integrated Devices**, and then change the setting for **Network Interface Card** to **Off**.

11. Connect the network cable to the integrated connector on the computer back panel.

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# Chassis Intrusion Switch

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**CAUTION: Before you begin any of the procedures in this section, follow the safety instructions in the *System Information Guide*.**

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## Removing the Chassis Intrusion Switch

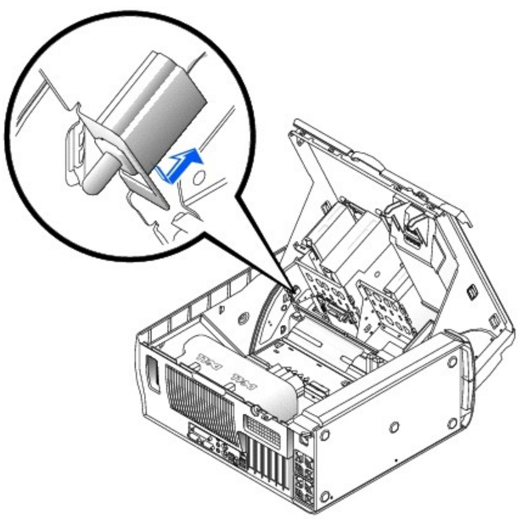
**NOTICE:** Before disconnecting a device from the computer or removing a component from the system board, verify that the standby power light on the system board has turned off. To locate this light on the Dell Precision 650 computer, see "System Board Components" or on the Dell Precision 450 computer, see "System Board Components."

1. Remove the front panel.
2. Disconnect the chassis-intrusion switch cable from the I/O Panel connector.
3. Feed the chassis-intrusion switch cable through the routing holes in the drive door and the front of the computer.

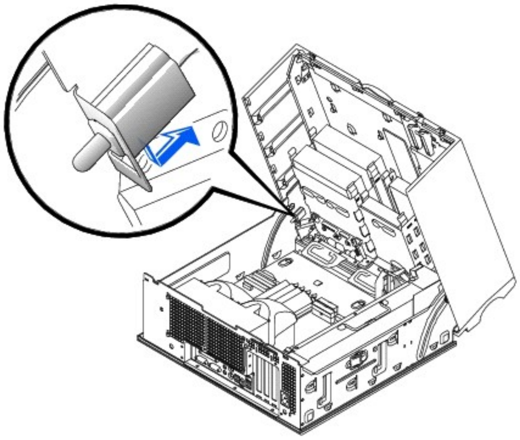
**NOTE:** On the Dell Precision 650, you must open the drive door to feed the chassis-intrusion switch cable through the routing holes.

4. Slide the chassis intrusion switch up out of its slot.
5. Lift both the chassis intrusion switch and the switch cable away from the computer.

**Dell Precision 650 Computer**



**Dell Precision 450 Computer**



## Replacing the Chassis Intrusion Switch

To replace the chassis intrusion switch, perform the removal procedure in reverse.

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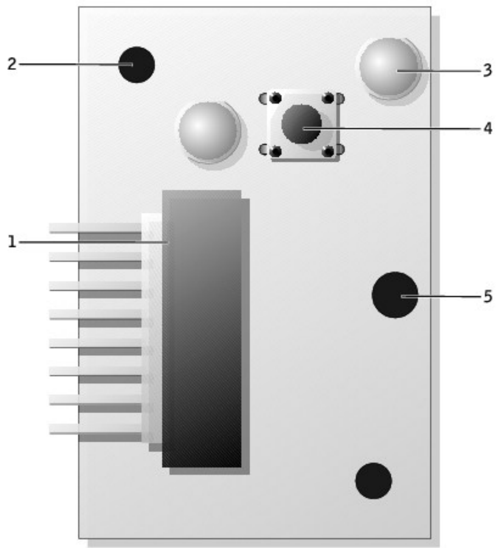
# Control Panel

**Dell Precision™ Workstation 650 and Dell Precision Workstation 450 Service Manual**

- Control Panel Components
- Removing the Control Panel
- Replacing the Control Panel

**CAUTION: Before you begin any of the procedures in this section, follow the safety instructions in the *System Information Guide*.**

## Control Panel Components



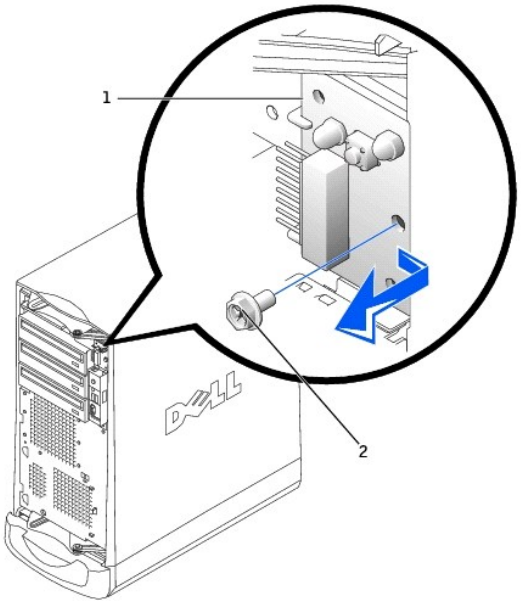

| | |
|---|---|
| 1 | control-panel connector |
| 2 | alignment hole |
| 3 | hard-drive access light |
| 4 | power button |
| 5 | screw hole |

## Removing the Control Panel

**NOTICE:** Before disconnecting a device from the computer or removing a component from the system board, verify that the standby power light on the system board has turned off. To locate this light on the Dell Precision 650 computer, see "System Board Components" or on the Dell Precision 450 computer, see "System Board Components."

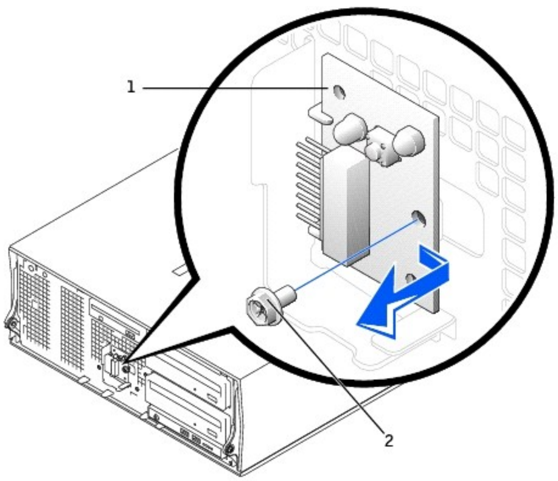
1. Remove the front panel.
2. Disconnect the control-panel cable from the I/O panel connector.
3. Disconnect the I/O panel cable from the connector on the system board. To locate the system board connector on the Dell Precision 650 computer, see "System Board Components" or on the Dell Precision 450 computer, see "System Board Components."
4. Remove the mounting screw from the control panel.
5. Lift the control panel away from the computer.

**Dell Precision 650 Computer**




| | |
|---|---|
| 1 | control panel |
| 2 | mounting screw |

**Dell Precision 450 Computer**




| | |
|---|---|
| 1 | control panel |
| 2 | mounting screw |

## Replacing the Control Panel

To replace the control panel, perform the removal procedure in reverse.

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# Inside Your Computer — Dell Precision™ 450 Computer

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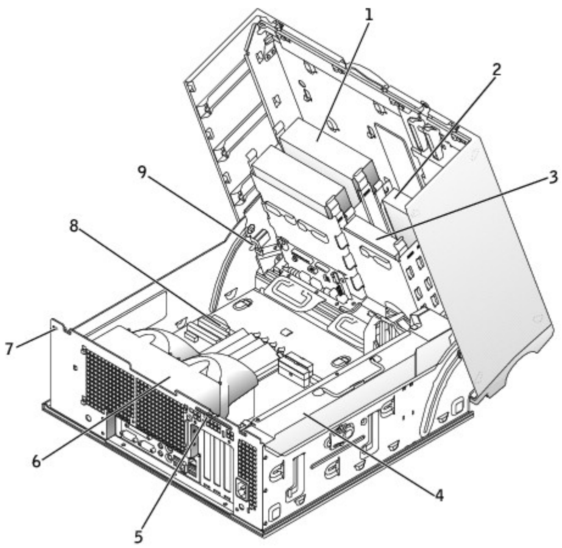


**CAUTION: Before you begin any of the procedures in this section, follow the safety instructions in the *System Information Guide*.**

**CAUTION: To avoid electrical shock, always unplug your computer from the electrical outlet before opening the cover.**

**NOTICE:** Be careful when opening the computer cover to ensure that you do not accidentally disconnect cables from the system board.

## Inside View of Your Computer

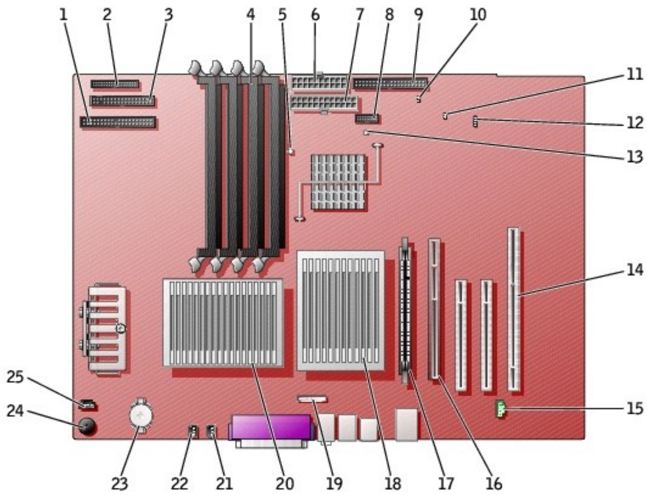



| | | | |
|---|---|---|---|
| 1 | CD/DVD drive | 6 | microprocessor airflow shroud |
| 2 | floppy drive | 7 | security cable slot |
| 3 | hard drive | 8 | system board |
| 4 | power supply | 9 | chassis intrusion switch |
| 5 | padlock ring | | |

**Cable Colors**

| **Device** | **Cable Color** |
|---|---|
| Hard drive | Blue pull tab |
| Floppy drive | Black pull tab |
| CD/DVD drive | Orange pull tab |
| I/O Panel | Yellow pull tab |

## System Board Components




| | | | |
|---|---|---|---|
| 1 | CD/DVD drive connector (IDE2) | 14 | PCI card connectors (PCI1, PCI2 [32-bit connectors], and PCI3 [64-bit PCI-X connector]) |
| 2 | I/O panel (I/O PANEL) | 15 | telephony connector (MODEM) |
| 3 | floppy drive connector (DISKETTE) | 16 | AGP Pro card connector (AGP) |
| 4 | memory module connectors (DIMM_1, DIMM_2, DIMM_3, DIMM_4) | 17 | VRM connector (VRM) (for a second microprocessor only) |
| 5 | suspend-to-RAM light (STR_LED) | 18 | microprocessor and heat-sink connector (CPU_1) |
| 6 | power connector (POWER 2) | 19 | front-panel audio connector (FP2AUDIO) |
| 7 | power connector (POWER 1) | 20 | microprocessor and heat-sink connector (CPU_0) |
| 8 | USB connector (USB) | 21 | microprocessor fan connector (FAN_P1) |
| 9 | hard-drive connector (IDE1) | 22 | microprocessor fan connector (FAN_P0)) |
| 10 | real-time clock reset jumper (RTCRST) | 23 | battery socket (BATTERY) |
| 11 | password jumper (PSWD) | 24 | internal speaker (SPKR) |
| 12 | auxiliary LED add-in storage adapter connector (AUX_LED) | 25 | CD drive audio cable connector (CD_IN) |
| 13 | standby power light (AUX_PWR_LED) | | |

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# Drives — Dell Precision™ 450 Computer

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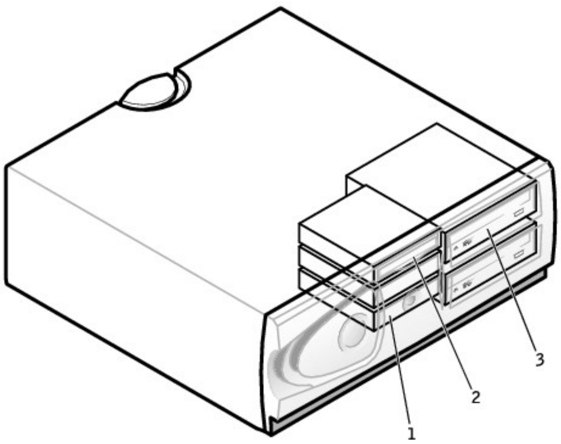


**CAUTION: Before you begin any of the procedures in this section, follow the safety instructions in the *System Information Guide*.**

## Overview

Your computer supports:

- Two hard drives
- One floppy drive
- Two CD or DVD drives




| | |
|---|---|
| 1 | hard drive(s) |
| 2 | floppy drive(s) |
| 3 | CD/DVD drives(s) |

### IDE Drive Addressing

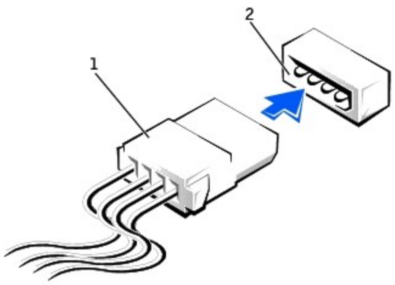
When you connect two IDE devices to a single IDE interface cable and configure them for the cable select setting, the device attached to the last connector on the interface cable is the primary (master) or boot device (drive 0), and the device attached to the middle connector on the interface cable is the secondary (slave) device (drive 1). See the drive documentation in your upgrade kit for information on configuring devices for the cable select setting.

Since cable select is the default setting, any additional drives that are installed do not need to be set as a primary or secondary drive.

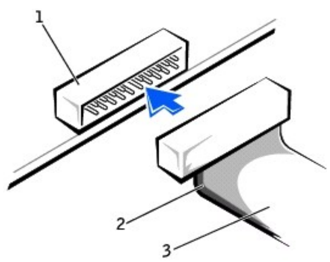
Your computer supports up to two IDE devices. Hard drives should be connected to the connector labeled "IDE1," and CD/DVD drives should be connected to the connector labeled "IDE2."

### Connecting Drive Cables

When you install a drive, you connect two cables—a DC power cable and an interface cable—to the back of the drive.




| | |
|---|---|
| 1 | power cable |
| 2 | power input connector |




| | |
|---|---|
| 1 | interface connector |
| 2 | colored stripe on cable |
| 3 | interface cable |

Most interface connectors are keyed for correct insertion; that is, a notch or a missing pin on one connector matches a tab or a filled-in hole on the other connector. Keyed connectors ensure that the pin-1 wire in the cable (indicated by the colored stripe along one edge of the cable) goes to the pin-1 end of the connector. The pin-1 end of a connector on a board or a card is usually indicated by a silk-screened "1" printed directly on the board or card.

**NOTICE:** When you connect an interface cable, do not place the colored stripe away from pin 1 of the connector. Reversing the cable prevents the drive from operating and could damage the controller, the drive, or both.

## SCSI Device Installation Guidelines

This section describes how to configure and install SCSI devices in your computer.

## SCSI ID Numbers

Internal SCSI devices must have a unique SCSI ID number from 0 to 15. If you are using the SCSI connector on the system board and a SCSI controller card installed in your computer, you have two separate SCSI buses operating. Each SCSI bus has a set of SCSI ID numbers from 0 to 15.

When SCSI devices are shipped from the factory, the default SCSI ID numbers are assigned as follows:

| System Board Controller | | Controller Card | |
|---|---|---|---|
| **Device** | **ID** | **Device** | **ID** |
| Controller | 7 | Controller | 7 |
| Boot hard drive | 0 | Boot hard drive | 0 |
| | | CD or DVD drive | 5 |
| | | tape or DAT drive | 6 |
| **NOTE:** There is no requirement that SCSI ID numbers be assigned sequentially or that devices be attached to the cable in order by ID number. If two or more devices use the same ID, your computer may hang during POST and in SCSI BIOS. | | | |

SCSI devices installed by Dell are configured correctly during the manufacturing process. You do not need to set the SCSI ID for these SCSI devices.

If you attach additional optional SCSI devices, see the documentation for each device for information about setting the appropriate SCSI ID number.

**NOTICE:** Dell recommends that you use only SCSI cables purchased from Dell. Cables purchased elsewhere are not guaranteed to work with Dell computers.

## Device Termination

SCSI logic requires that termination be enabled for the two devices at opposite ends of the SCSI chain and disabled for all devices in between.

It is recommended that you use terminated cables and that you disable termination on all devices. See the documentation provided with any optional SCSI device you purchase for information on disabling termination on the device.

### General Guidelines

Follow these general guidelines when installing SCSI devices in your computer:

- Although you install SCSI devices essentially the same way as other devices, their configuration requirements are different. For details on configuring your particular SCSI subsystem, see the documentation for your SCSI devices and/or your host adapter card.
- Configure the device for a SCSI ID number and disable termination, if necessary.
- To use an external SCSI device, you must have a SCSI controller card installed in your computer. Connect one end of the external SCSI cable to the connector on the back of the SCSI device. Attach the other end of the external SCSI cable to the connector on the controller card installed in the computer.
- After you install a SCSI hard drive, **Primary Drive 0** and **Primary Drive 1** should be set to **None** in system setup if no IDE hard drives are installed. If you have any EIDE devices on the second IDE channel, such as a CD or tape drive, **Secondary Drive 0** and/or **Secondary Drive 1** should be set to **Auto**.
- You may need to use programs other than those provided with the operating system to partition and format SCSI hard drives. See the documentation that came with your SCSI software drivers for information on installing the appropriate drivers and preparing your SCSI hard drive for use.

### SCSI Cables

Ultra 320 (optional on the Dell Precision 450 computer), Ultra 160/m and Ultra2/Wide LVD drives (typically hard drives) both use a 68-pin cable. One end of the cable attaches to the SCSI connector on the SCSI controller card installed in your computer. The remaining connectors on the cable attach to the various drives.

Narrow SCSI drives (tape drives, CD drives, and some hard drives) use a 50-pin cable. One end of this cable attaches to the SCSI controller card. The remaining connectors on the cable attach to the various Narrow SCSI devices.

**NOTICE:** Dell recommends that you use only SCSI cables purchased from Dell. Cables purchased elsewhere are not guaranteed to work with Dell computers.

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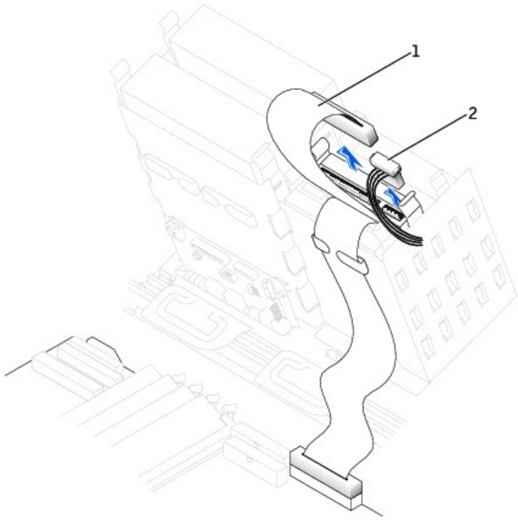
## Hard Drive

**CAUTION: Before you begin any of the procedures in this section, follow the safety instructions in the *System Information Guide*.**

**NOTICE:** To avoid damage to the drive, do not set it on a hard surface. Instead, set the drive on a surface, such as a foam pad, that will sufficiently cushion it.

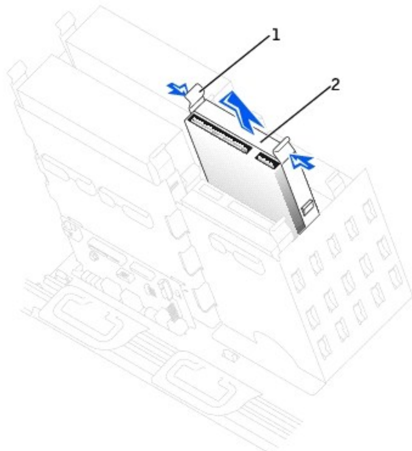
### Removing a Hard Drive

1. If you are replacing a hard drive that contains data you want to keep, back up your files before you begin this procedure.
2. Disconnect the power and hard-drive cables from the drive.




| | |
|---|---|
| 1 | hard-drive cable |
| 2 | power cable |

3. Press in on the tabs on each side of the drive and slide the drive up and out.



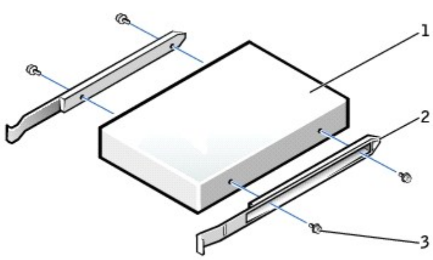

| | |
|---|---|
| 1 | tabs (2) |
| 2 | hard drive |

## Installing a Hard Drive

1. Unpack the replacement hard drive, and prepare it for installation.

2. Check the documentation for the drive to verify that it is configured for your computer.

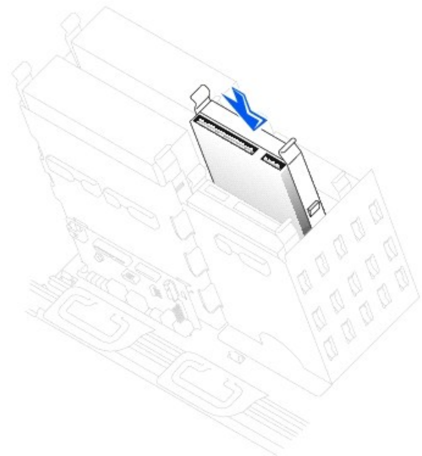
3. If your replacement hard drive does not have the bracket rails attached, remove the rails from the old drive by removing the two screws that secure each rail to the drive. Attach the bracket rails to the new drive by aligning the screw holes on the drive with the screw holes on the bracket rails and then inserting and tightening all four screws (two screws on each rail).




| | |
|---|---|
| 1 | drive |
| 2 | bracket rails (2) |
| 3 | screws (4) |

4. Gently slide the drive into place until the tabs securely click into position.

**NOTE:** If you are installing a hard drive in the lower bay, the drive should be placed in the bay so that the power connector is on the left- hand side (opposite of the top hard drive).

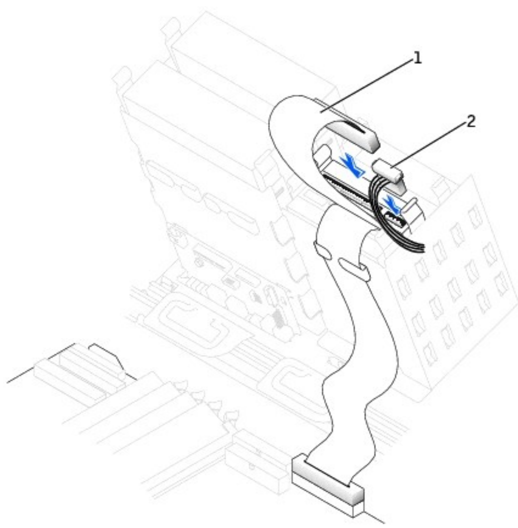


5. If you are installing a drive that has its own controller card, install the controller card in an expansion slot.

   See the documentation that accompanied the drive and controller card to verify that the configuration is correct for your computer.

**NOTICE:** Match the colored strip on the cable with pin 1 on the drive (pin 1 is marked as "1").

6. Connect the power and hard-drive cables to the drive.




| | |
|---|---|
| 1 | hard-drive cable |
| 2 | power cable |

7. Check all connectors to be certain that they are properly cabled and firmly seated.
8. Close the computer cover.

**NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

9. Connect your computer and devices to electrical outlets, and turn them on.

   See the documentation that came with the drive for instructions on installing any software required for drive operation.

10. If the drive you just installed is the primary drive, insert a bootable floppy disk into drive A.
11. Turn on the computer.
12. Enter system setup, and update the your drive configuration.
13. After you have updated the system settings, exit system setup, and restart the computer.
14. Partition and logically format your drive before you proceed to the next step.

See the documentation for your operating system for instructions.

15. Test the hard drive by running the Dell Diagnostics.
16. If the drive you just installed is the primary drive, install your operating system on the hard drive.

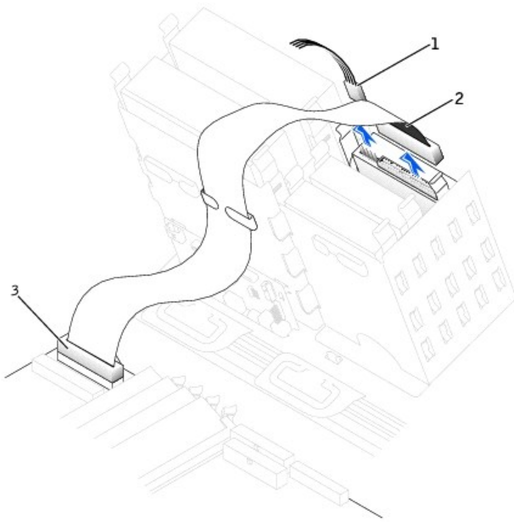
---

# Floppy Drive

**CAUTION: Before you begin any of the procedures in this section, follow the safety instructions in the *System Information Guide*.**

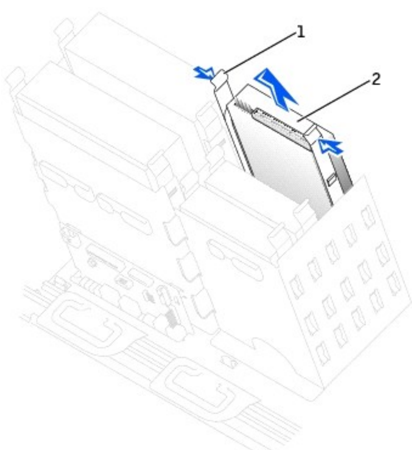
## Removing a Floppy Drive

1. Disconnect the power and floppy-drive cables from the back of the floppy drive.




| | |
|---|---|
| 1 | power cable |
| 2 | floppy-drive cable |
| 3 | floppy-drive connector (DSKT) |

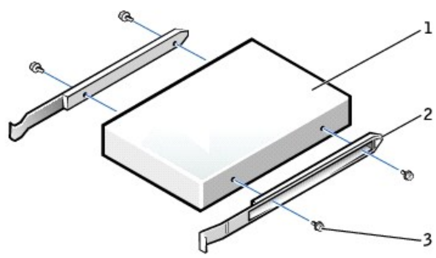
2. Press inward on the two tabs on the sides of the drive, slide the drive upward, and remove it from the floppy-drive bay.




| | |
|---|---|
| 1 | tabs (2) |
| 2 | floppy drive |

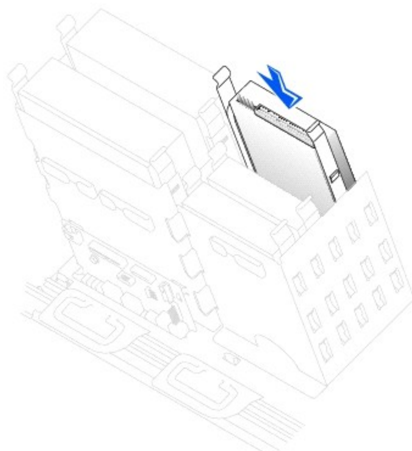
## Installing a Floppy Drive

1. If you are replacing a drive and the the new drive does not have the bracket rails attached, remove the rails from the old drive by removing the two screws that secure each rail to the drive. Attach the bracket to the new drive by aligning the screw holes on the drive with the screw holes on the bracket rails and then inserting and tightening all four screws (two screws on each rail).

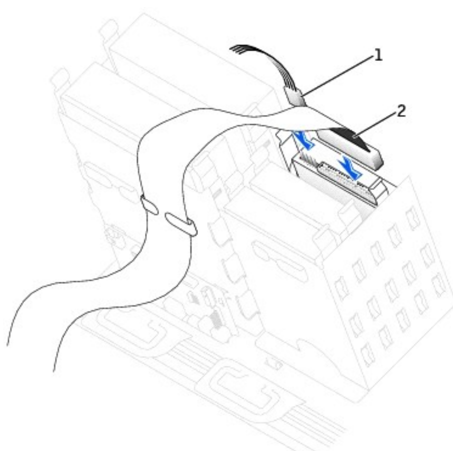



| | |
|---|---|
| 1 | drive |
| 2 | bracket rails (2) |
| 3 | screws (4) |

2. Gently slide the drive into place until the tabs securely click into position.



3. Attach the power and floppy-drive cables to the floppy drive.



| | |
|---|---|
| 1 | power cable |
| 2 | floppy-drive cable |

4. If you are installing a new floppy drive rather than replacing a drive, remove the front-panel inserts.

   From inside the drive bay, gently press on each side of the insert until it pops out.

5. Check all cable connections, and fold cables out of the way to provide airflow for the fan and cooling vents.
6. Close the computer cover.

**NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

7. Connect your computer and devices to electrical outlets, and turn them on.

   See the documentation that came with the drive for instructions on installing any software required for drive operation.

8. Enter system setup and update the appropriate **Diskette Drive A** option to reflect the size and capacity of your new floppy drive.
9. To verify that your computer works correctly, run the Dell Diagnostics.

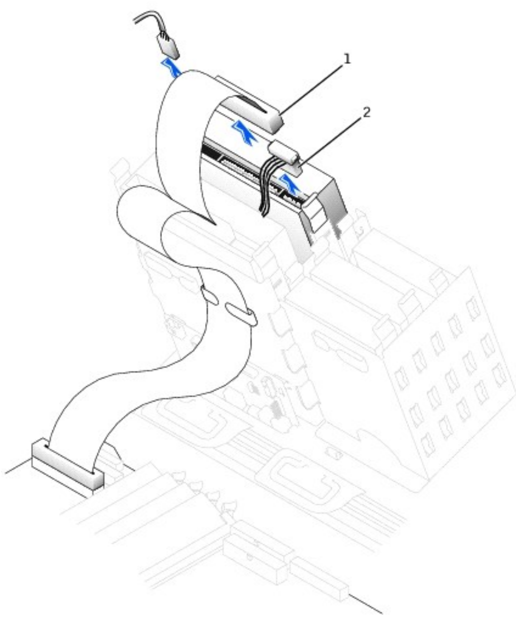
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# CD/DVD Drive

**CAUTION: Before you begin any of the procedures in this section, follow the safety instructions in the *System Information Guide*.**

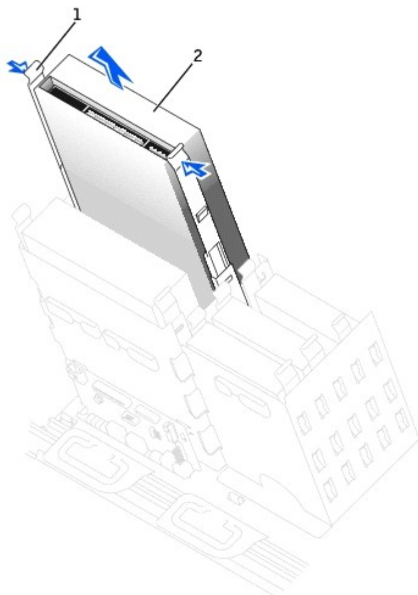
## Removing a CD/DVD Drive

1. Disconnect the power and CD/DVD drive cables from the back of the drive.




| | |
|---|---|
| 1 | CD/DVD drive cable |
| 2 | power cable |

2. Press inward on the two tabs on the sides of the drive, and then slide the drive upward and remove it from the drive bay.




| | |
|---|---|
| 1 | tabs (2) |
| 2 | CD/DVD drive |

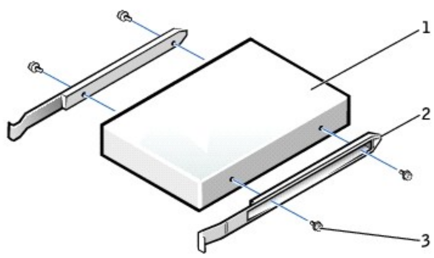
## Installing a CD/DVD Drive

1. If you are installing a new drive, unpack the drive and prepare it for installation.

   Check the documentation that accompanied the drive to verify that the drive is configured for your computer. If you are installing an IDE drive, configure the drive for the cable select setting.

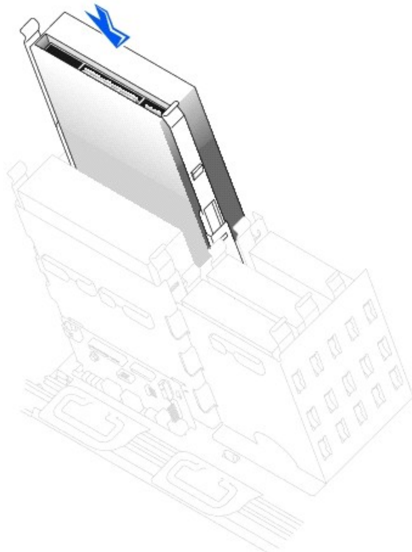
2. Connect the new drive to the set of rails that are attached to the inside of the computer cover. If a set of rails is not attached inside the cover, contact Dell.

3. If you are installing a replacement drive and the new drive does not have the bracket rails attached, remove the rails from the old drive by removing the two screws that secure each rail to the drive. Attach the bracket to the new drive by aligning the screw holes on the drive with the screw holes on the bracket rails and then inserting and tightening all four screws (two screws on each rail).




| | |
|---|---|
| 1 | drive |
| 2 | bracket rails (2) |
| 3 | screws (4) |

4. Gently slide the drive into place until the tabs securely click into position.

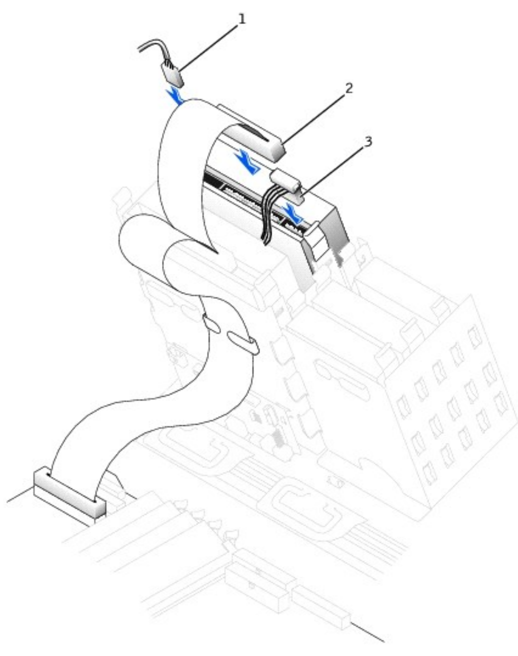


5. If you are installing a drive that has its own controller card, install the controller card in an expansion slot.

   See the documentation that accompanied the drive and controller card to verify that the configuration is correct for your computer.

6. Connect the power and CD/DVD drive cables to the drive.

   If you are adding a drive that has an audio cable, connect the audio cable to the audio connector on the system board.




| | |
|---|---|
| 1 | audio cable (some drives do not have this cable) |
| 2 | CD/DVD drive cable |
| 3 | power cable |

7. If you are installing a new CD/DVD drive rather than replacing a drive, remove the front-panel inserts.

   From inside the drive bay, gently press on each side of the insert until it pops out.

8. Check all cable connections, and fold cables out of the way to provide airflow for the fan and cooling vents.

9. Close the computer cover.

**NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

10. Connect your computer and devices to electrical outlets, and turn them on.

    See the documentation that came with the drive for instructions on installing any software required for drive operation.

11. Update your configuration information by setting the appropriate **Drive** option (**0** or **1**) under **Drives**: **Secondary** to **Auto**. See "Advanced Features" in your *User's Guide* for more information.

12. To verify that your computer works correctly, run the Dell Diagnostics.

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# Power Supply — Dell Precision™ 450 Computer

**Dell Precision™ Workstation 650 and Dell Precision Workstation 450 Service Manual**

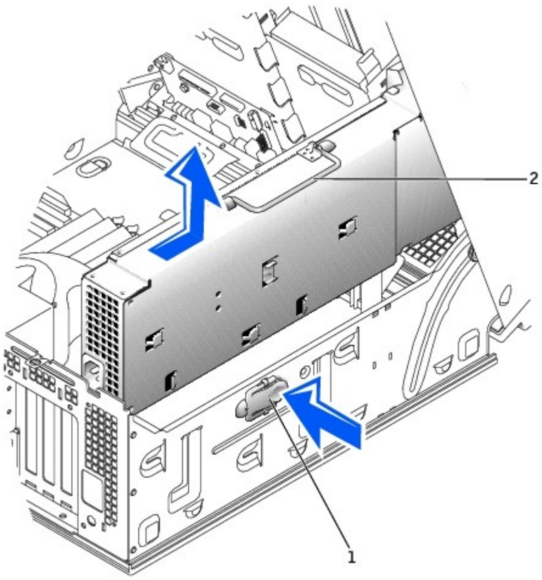


**CAUTION: Before you begin any of the procedures in this section, follow the safety instructions in the *System Information Guide*.**

## Removing the Power Supply

**NOTICE:** Before disconnecting a device from the computer, wait 10 to 20 seconds after disconnecting the computer from its electrical outlet. Before removing a component from the system board, verify that the standby power light on the system board has turned off. To locate this light, see "System Board Components."

1. Disconnect the power supply cables from the system board.
2. Lift the handle on the power supply.
3. While pressing the release button, slide the power supply toward the front of the computer.




| | |
|---|---|
| 1 | release button |
| 2 | power supply handle |

4. Lift the power supply away from the computer.

## Replacing the Power Supply

1. Insert the power-supply securing tabs into the power-supply securing slot on the computer, ensuring that each securing tab is connected to its slot on the computer.
2. Slide the power supply toward the back of the computer.
3. Connect the power supply cables.
4. Close the computer cover and restart the computer.

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# Drive Door — Dell Precision™ 650 Computer

**Dell Precision™ Workstation 650 and Dell Precision Workstation 450 Service Manual**

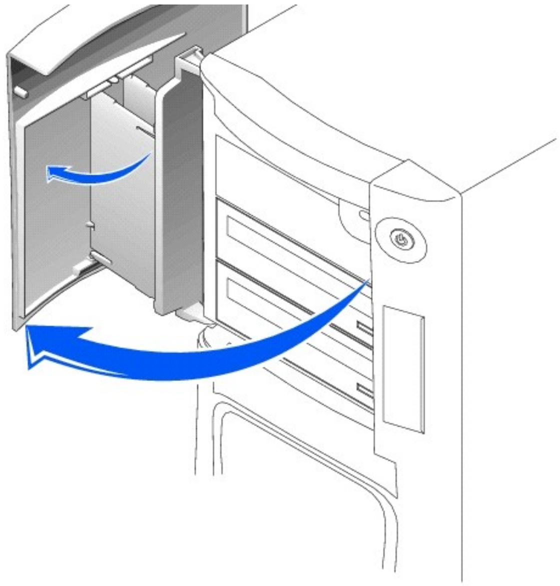
- [Removing the Drive Door](#)
- [Replacing the Drive Door](#)

**CAUTION: Before you begin any of the procedures in this section, follow the safety instructions in the *System Information Guide*.**

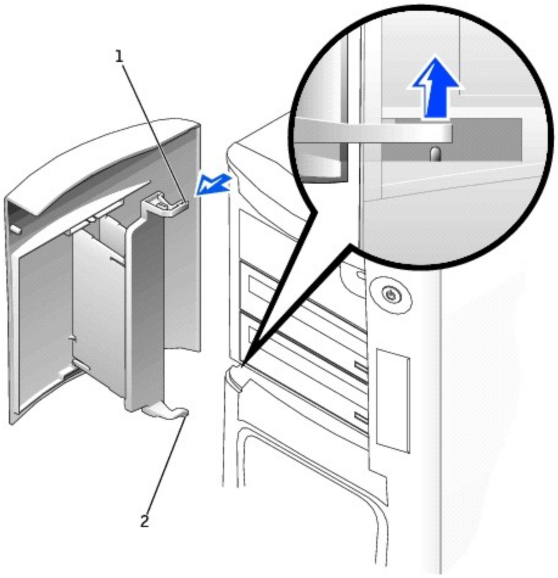
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## Removing the Drive Door

1. Open the drive door.



2. Unsnap the top hinge and pull the top of the drive door outward, away from the computer.




| | |
|---|---|
| 1 | top hinge |
| 2 | bottom hinge |

3. Lift the bottom hinge away from the computer.

---

## Replacing the Drive Door

To replace the drive door, perform the removal procedure in reverse.

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# Microprocessor Airflow Shroud — Dell Precision™ 450 Computer

**Dell Precision™ Workstation 650 and Dell Precision Workstation 450 Service Manual**

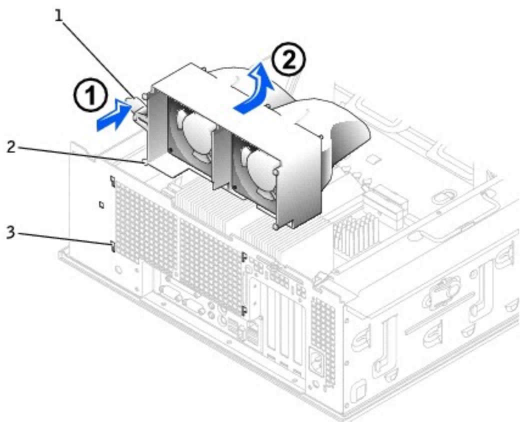


**CAUTION: Before you begin any of the procedures in this section, follow the safety instructions in the *System Information Guide*.**

## Removing the Microprocessor Airflow Shroud

**NOTICE:** To avoid damaging the fan power cables, do not slide the shroud too quickly.

1. Press the shroud release lever towards the front of the computer and lift the shroud up to disengage the anchors.
2. Once the shroud has been disengaged from the anchors, unplug the fan cables from their connectors on the system board.




| | |
|---|---|
| 1 | shroud release lever |
| 2 | anchor tabs |
| 3 | anchor slots |

## Installing the Microprocessor Airflow Shroud

1. Attach both fan power cables to the connectors on the system board.
2. Align the anchor tabs with the securing slots.
3. Gently press the shroud until the anchor tabs snap securely into place.
4. Close the computer cover.

**NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

5. Connect your computer and devices to electrical outlets, and turn them on.

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# Card Fan and Guide — Dell Precision 650 Computer

**Dell Precision™ Workstation 650 and Dell Precision Workstation 450 Service Manual**

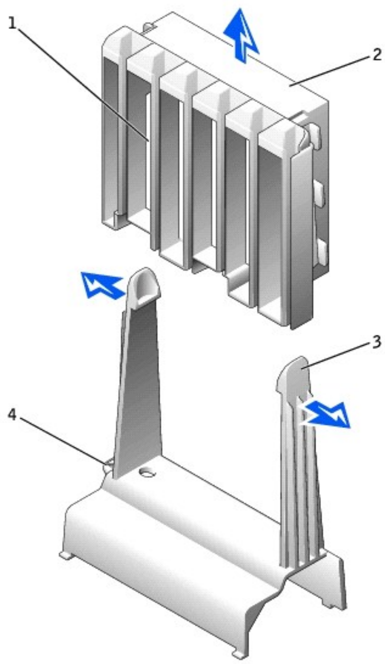


## Removing the Card Fan and Guide

**CAUTION: Before you begin any of the procedures in this section, follow the safety instructions in the *System Information Guide*.**

**NOTICE:** Before disconnecting a device from the computer or removing a component from the system board, verify that the standby power light on the system board has turned off. To locate this light, see "System Board Components."

1. Disconnect the fan power cable from its connector on the system board. To locate this connector, see "System Board Components."
2. Press the release tabs outward from the card fan guide, and lift the fan up and out of the guide.




| | |
|---|---|
| 1 | card fan guide |
| 2 | card fan |
| 3 | release button (2) |
| 4 | card-fan guide-release button |

## Replacing the Card Fan and Guide

**NOTICE:** Ensure that the fan is properly installed on the guide. When the fan is properly installed, the fan manufacturer label faces the expansion-card guide, and the fan power cable extends toward the system board.

Insert the bottom of the fan into the clips on the card fan guide. Then press the top of the fan toward the card fan guide until the tabs on the card fan guide grasp the fan. See "Removing the Card Fan and Guide."

## The Card Fan Guide

If you need to remove the card fan guide, pull up on the card-fan guide-release button and slide the guide up and out of the computer. To replace the card fan guide, insert the card-fan guide anchor tabs into the slots on the computer and slide the guide into position.

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# Front Panel

**Dell Precision™ Workstation 650 and Dell Precision Workstation 450 Service Manual**



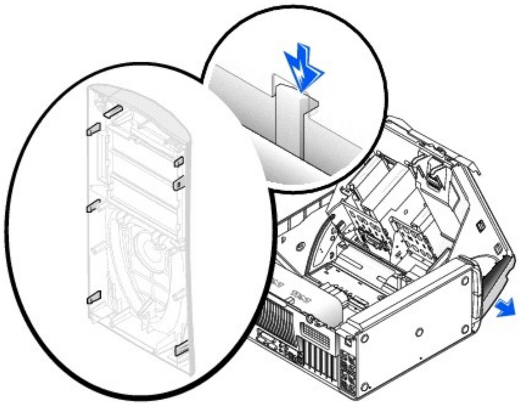
**CAUTION: Before you begin any of the procedures in this section, follow the safety instructions in the *System Information Guide*.**

## Removing the Front Panel

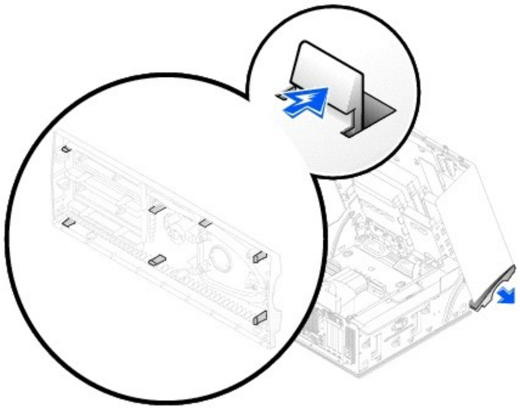
1. Disconnect and remove all disk drives (for more information, see "Drives — Dell Precision™ 650 Computer" or "Drives — Dell Precision™ 450 Computer."
2. Release the front panel by pressing each of the front-panel release tabs.

   The Dell Precision 650 computer has seven release tabs and the Dell Precision 450 computer has seven release tabs.

**Dell Precision 650 Computer**



**Dell Precision 450 Computer**



3. Close the computer cover halfway and pull the front panel away from the computer.

## Replacing the Front Panel

To replace the front panel, perform the removal procedure in reverse.

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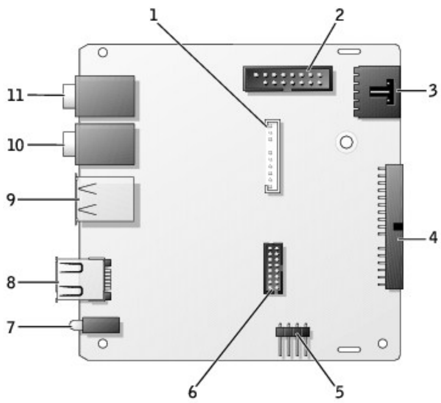
# I/O Panel

**Dell Precision™ Workstation 650 and Dell Precision Workstation 450 Service Manual**



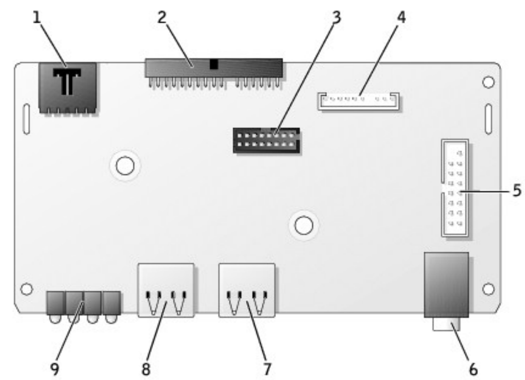
**CAUTION: Before you begin any of the procedures in this section, follow the safety instructions in the *System Information Guide*.**

## I/O Panel Components for the Dell Precision 650 Computer




| | | | |
|---|---|---|---|
| 1 | front-panel audio connector | 7 | diagnostic lights (4) |
| 2 | control panel connector | 8 | IEEE 1394 connector |
| 3 | chassis-intrusion switch connector | 9 | USB 2.0 connectors (2) |
| 4 | system board connector | 10 | microphone connector |
| 5 | speaker connector | 11 | headphone connector |
| 6 | front-panel USB/IEEE 1394 connector | | |

## I/O Panel Components for the Dell Precision 450 Computer



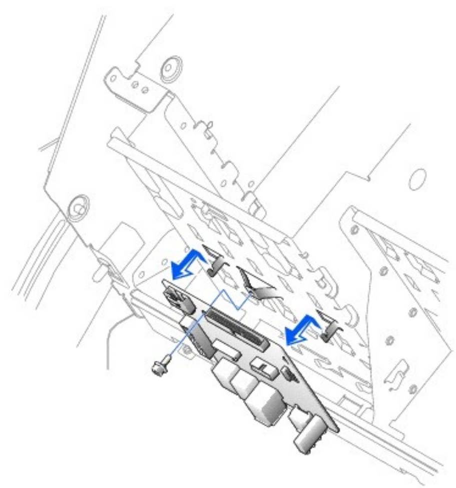

| | | | |
|---|---|---|---|
| 1 | chassis-intrusion switch connector | 6 | headphone connector |
| 2 | system board connector | 7 | USB 2.0 connector |
| 3 | USB 2.0 connector | 8 | USB 2.0 connector |
| 4 | front-panel audio connector | 9 | diagnostic lights (4) |

| 5 | control panel connector | | |
|---|---|---|---|

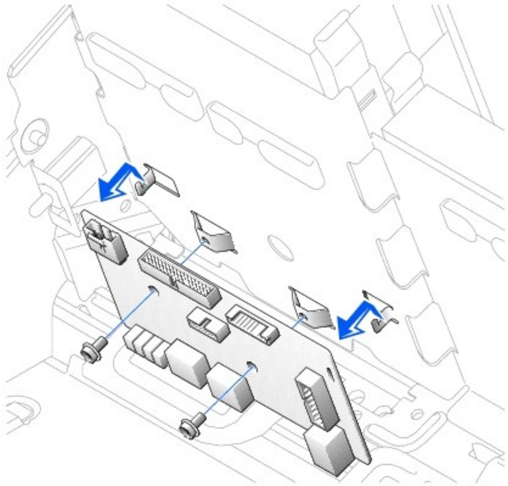
## Removing the I/O Panel

1. Remove the front panel.
2. Disconnect the control panel cable from the control panel connector.
3. Disconnect the front-panel cable from the system board.
4. Remove all cables that are connected to the front I/O panel.
5. From inside the cover, remove the mounting screw that secures the front I/O panel to the computer.
6. Remove the front I/O panel from the computer.

**Dell Precision 650 Computer**



**Dell Precision 450 Computer**



## Replacing the I/O Panel

To replace the front I/O panel, perform the removal procedure in reverse.

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# Inside Your Computer — Dell Precision™ 650 Computer

**Dell Precision™ Workstation 650 and Dell Precision Workstation 450 Service Manual**

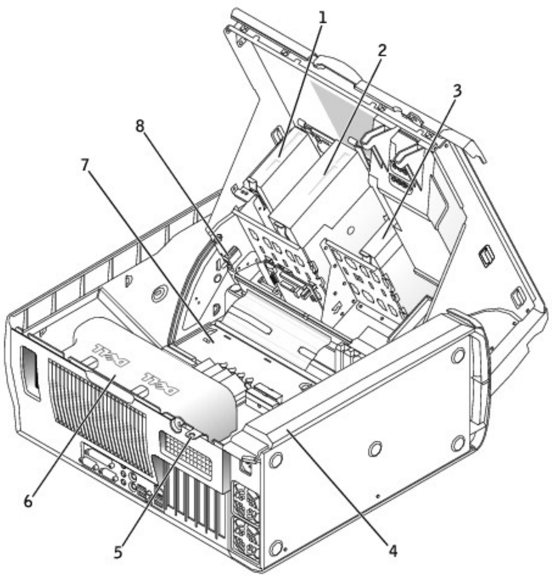


**CAUTION: Before you begin any of the procedures in this section, follow the safety instructions in the *System Information Guide*.**

**CAUTION: To avoid electrical shock, always unplug your computer from the electrical outlet before opening the cover.**

**NOTICE:** Be careful when opening the computer cover to ensure that you do not accidentally disconnect cables from the system board.

## Inside View of Your Computer

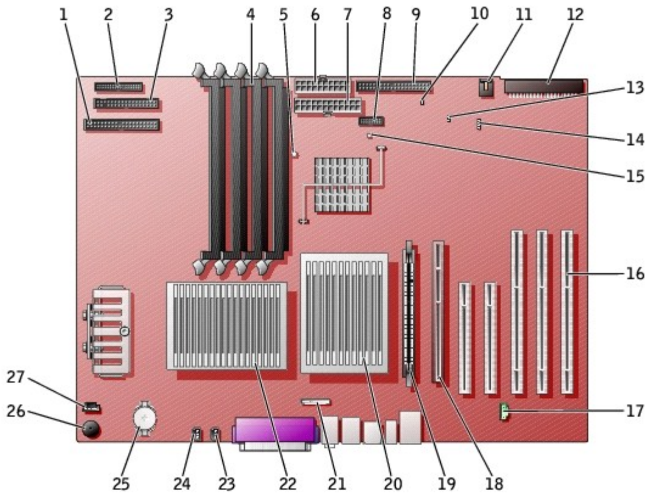



| | | | |
|---|---|---|---|
| 1 | floppy drive | 5 | padlock ring |
| 2 | CD/DVD drive | 6 | microprocessor airflow shroud |
| 3 | hard drive | 7 | system board |
| 4 | power supply | 8 | chassis intrusion switch |

**Cable Colors**

| **Device** | **Cable Color** |
|---|---|
| Hard drive | Blue pull tab |
| Floppy drive | Black pull tab |
| CD/DVD drive | Orange pull tab |
| I/O Panel | Yellow pull tab |

## System Board Components




| | | | |
|---|---|---|---|
| 1 | CD/DVD drive connector (IDE2) | 15 | standby power light (AUX_PWR_LED) |
| 2 | I/O panel connector (I/O PANEL) | 16 | PCI card connectors (PCI1, PCI2 [32-bit connectors], PCI3 , PCI4, and PCI5 [64-bit PCI-X connectors]) |
| 3 | floppy-drive connector (DISKETTE) | 17 | telephony connector (MODEM) |
| 4 | memory module connectors (DIMM_1, DIMM_2, DIMM_3, DIMM_4) | 18 | AGP Pro card connector (AGP) |
| 5 | suspend-to-RAM light (STR_LED) | 19 | VRM connector (VRM)(for a second microprocessor only) |
| 6 | power connector (POWER 2) | 20 | microprocessor and heat-sink connector (CPU_1) |
| 7 | power connector (POWER 1) | 21 | front-panel audio connector (FP2AUDIO) |
| 8 | front-panel USB/IEEE 1394 connector (USB) | 22 | microprocessor and heat-sink connector (CPU_0) |
| 9 | hard-drive connector (IDE1) | 23 | microprocessor fan connector (FAN_P1) |
| 10 | real-time clock reset jumper (RTCRST) | 24 | microprocessor fan connector (FAN_P0) |
| 11 | card fan connector (FAN) | 25 | battery socket (BATTERY) |
| 12 | SCSI drive connector (SCSI) | 26 | internal speaker (SPKR) |
| 13 | password jumper (PSWD) | 27 | CD drive audio cable connector (CD_IN) |
| 14 | auxiliary LED add-in storage adapter connector (AUX_LED) | | |

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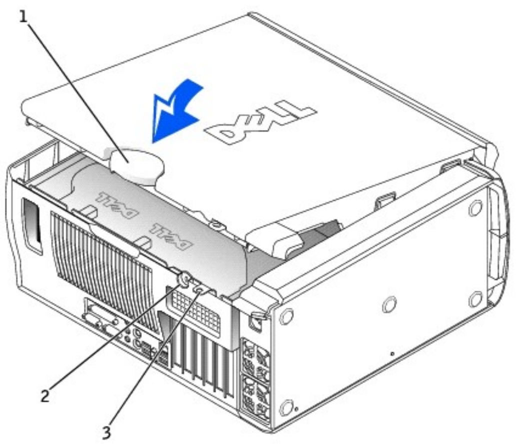
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# Closing the Computer Cover

**Dell Precision™ Workstation 650 and Dell Precision Workstation 450 Service Manual**

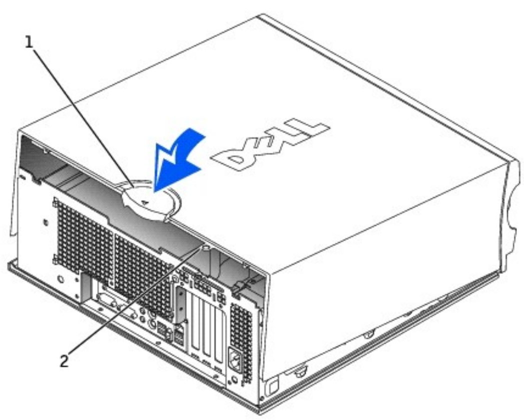
1. Ensure that all cables are connected, and fold cables out of the way.
2. Ensure that no tools or extra parts are left inside the computer.
3. Close the computer cover:
   a. Pivot the cover down and into position.
   b. If your computer has a baffle, ensure that the baffle is correctly positioned by guiding it into place as you lower the cover.
   c. Press down on the cover to close it.
   d. Once the cover is closed, slide the release latch to the right until the latch clicks into place.

**Dell Precision 650 Computer**




| | |
|---|---|
| 1 | cover release latch |
| 2 | security cable slot |
| 3 | padlock ring |

**Dell Precision 450 Computer**




| | |
|---|---|
| 1 | cover release latch |
| 2 | padlock ring |

4. If you are using a padlock to secure your computer, install the padlock.

**NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

5. Connect your computer and devices to electrical outlets, and turn them on.

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# Opening the Computer Cover

**Dell Precision™ Workstation 650 and Dell Precision Workstation 450 Service Manual**

**CAUTION: Before you begin any of the procedures in this section, follow the safety instructions in the *System Information Guide*.**

**CAUTION: To guard against electrical shock, always unplug your computer from the electrical outlet before opening the cover.**

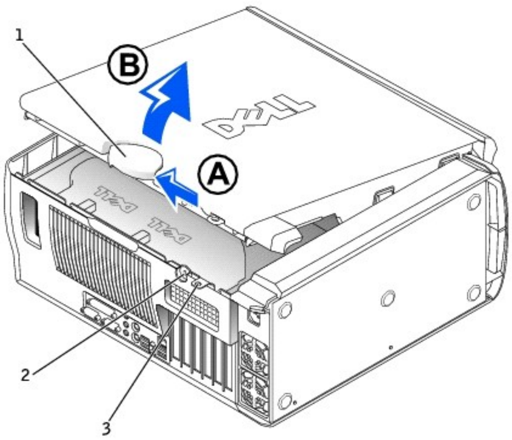
1. Lay the computer on its side as shown in the illustration.

**NOTICE:** Ensure that sufficient space exists to accommodate the open cover—at least 30 cm (1 ft) of desk top space.

2. Open the computer cover:
   a. Slide the cover release latch toward the top of the computer.
   b. Raise the cover, and pivot it toward the front of the computer.
3. Ground yourself by touching an unpainted metal surface on the computer, such as the metal at the back of computer, before touching anything inside your computer.

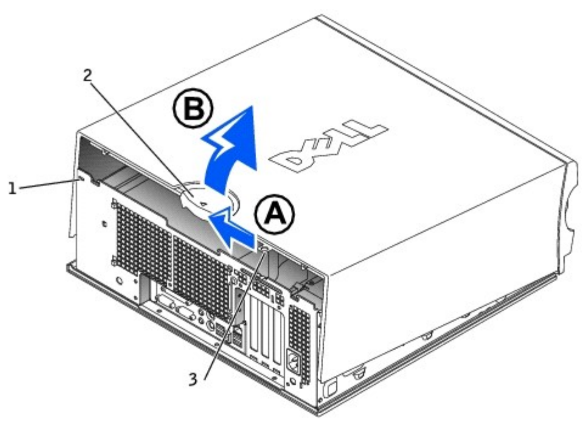
   While you work, periodically touch any unpainted metal surface on the computer to dissipate any static electricity that could harm internal components.

**Dell Precision 650 Computer**




| | |
|---|---|
| 1 | cover release latch |
| 2 | security cable slot |
| 3 | padlock ring |

**Dell Precision 450 Computer**



| | |
|---|---|
| 1 | security cable slot |
| 2 | cover release latch |
| 3 | padlock ring |

---

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# Microprocessor

**Dell Precision™ Workstation 650 and Dell Precision Workstation 450 Service Manual**

- Installation Guidelines
- Installing the Microprocessor
- Removing the Microprocessor

**CAUTION: Before you begin any of the procedures in this section, follow the safety instructions in the *System Information Guide*.**

## Installation Guidelines

- Your computer is designed for dual-processor operations. The heat sinks (CPU_0 and CPU_1) are keyed to fit their specific connector.
- For single-processor operations, the processor must be installed in socket CPU_0. The VRM for the single processor is already installed and cannot be removed. Processor socket 1 and VRM connector 1 must be empty. To locate these components, see the system board components illustration (for the Dell Precision 450 computer, see "System Board Components" or for the Dell Precision 650 computer, see "System Board Components") or the system board label inside your computer.
- For dual-processor operations, both processor sockets and the VRM connector must be populated. To locate the VRM connector, see the system board components illustration (for the Dell Precision 450 computer, see "System Board Components" or for the Dell Precision 650 computer, see "System Board Components")or the system board label inside your computer.
- For dual-processor operations, the two processors and the VRMs must be identical. If the processors do not match, you receive a system message. If the processors voltage don't match or the VRM is not properly installed, the diagnostic lights indicate an error..
- If you are upgrading your microprocessor, keep your original microprocessor heat sink and securing clips for future troubleshooting.

## Installing the Microprocessor

**CAUTION: The processor can get very hot during normal operation. Ensure that the processor has had sufficient time to cool before you touch it.**

1. Remove the microprocessor airflow shroud (for the Dell Precision 650 computer, see "Microprocessor Airflow Shroud — Dell Precision™ 650 Computer" or for the Dell Precision 450 computer, see "Microprocessor Airflow Shroud — Dell Precision™ 450 Computer").

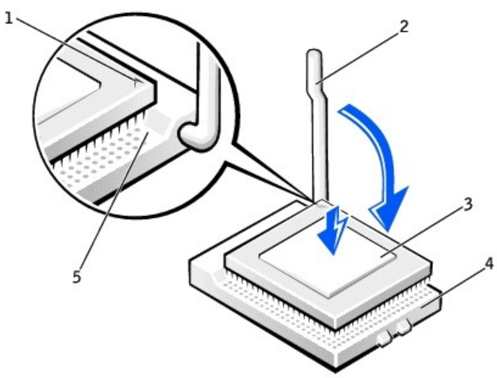
   If you are replacing a microprocessor, see "Removing the Microprocessor."

**NOTICE:** You must position the microprocessor correctly in the socket to avoid permanent damage to the microprocessor and the computer.

2. If the release lever is not extended to the release position, move it to that position.
3. Align pin-1 (the imprinted corner) of the microprocessor and pin-1 of the socket.

**NOTICE:** Microprocessor pins are delicate. To avoid damage, ensure that the microprocessor aligns properly with the socket, and do not use excessive force when you install the processor.

4. Carefully set the microprocessor in the socket and press it down lightly to seat it.
5. Rotate the release lever back toward the system board until it snaps into place, securing the microprocessor.




| | |
|---|---|
| 1 | microprocessor pin-1 indicator |
| 2 | release lever |
| 3 | microprocessor |
| 4 | microprocessor socket |

| | |
|---|---|
| 5 | socket pin-1 indicator |

6. Remove the thermal grease protective cover and place the heat sink in the base.

7. Place one end of the heat sink under the tab on the retention module on the side opposite the lever. Lower the heat sink onto the microprocessor so that the heat sink fits securely under the tab on the other end of the retention module.

8. Replace the retention module clips.

9. If you installed a microprocessor replacement kit from Dell, return the original heat sink assembly and microprocessor to Dell in the same package in which your replacement kit was sent.

10. If you are installing a second microprocessor, install the VRM.

11. Replace the airflow shroud (for the Dell Precision 650 computer, see "Microprocessor Airflow Shroud — Dell Precision™ 650 Computer" or for the Dell Precision 450 computer, see "Microprocessor Airflow Shroud — Dell Precision™ 450 Computer").

12. Close the computer cover.

**NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

13. Connect your computer and devices to electrical outlets, and turn them on.

---

## Removing the Microprocessor

**NOTE:** It is recommended that only a technically knowledgeable person perform this procedure.

**CAUTION: The processor can get very hot during normal operation. Ensure that the processor has had sufficient time to cool before you touch it.**

1. Remove the microprocessor airflow shroud (for the Dell Precision 650 computer, see "Microprocessor Airflow Shroud — Dell Precision™ 650 Computer" or for the Dell Precision 450 computer, see "Microprocessor Airflow Shroud — Dell Precision™ 450 Computer").

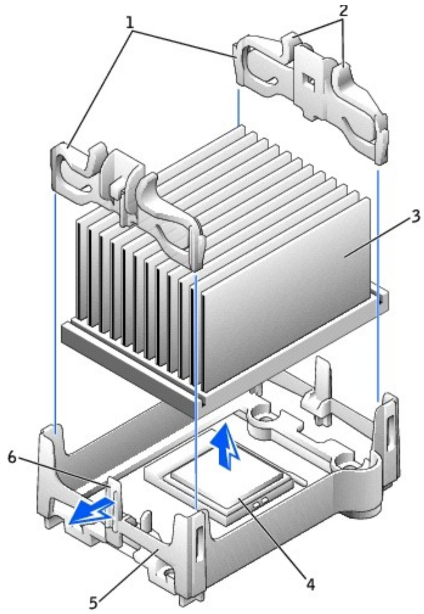
**NOTICE:** If you are installing a microprocessor upgrade kit from Dell, discard the original heat sink. If you are *not* installing a microprocessor upgrade kit from Dell, reuse the original heat sink when you install your new microprocessor.

2. Remove the microprocessor heat sink:

   a. Remove the two retention module clips by pressing the tabs together and lifting the retention module clips up.

   b. Press the lever on the retention module until the heat sink is released.

   c. Gently lift the heat sink away from the microprocessor.

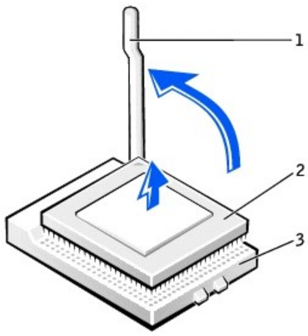



| | |
|---|---|
| 1 | retention module clips (2) |
| 2 | tabs (2 on each retention module clip) |
| 3 | heat sink |
| 4 | microprocessor socket |
| 5 | retention module |

| | |
|---|---|
| 6 | lever |

3. Pull the release lever straight up until the microprocessor is released.

**NOTICE:** Be careful not to bend any of the pins when you remove the microprocessor from the socket. Bending the pins can permanently damage the microprocessor.




| | |
|---|---|
| **1** | release lever |
| **2** | microprocessor |
| **3** | socket |

4. Remove the microprocessor from the socket.

   If you are replacing the microprocessor, leave the release lever extended in the release position so that the socket is ready for the new microprocessor and go to "Installing the Microprocessor."

   If you are removing a second microprocessor and not installing another one, remove the VRM and then continue with step 9.

5. Replace the airflow shroud (for the Dell Precision 650 computer, see "Microprocessor Airflow Shroud — Dell Precision™ 650 Computer" or for the Dell Precision 450 computer, see "Microprocessor Airflow Shroud — Dell Precision™ 450 Computer").

6. Close the computer cover.

**NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

7. Connect your computer and devices to electrical outlets, and turn them on.

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# Drives — Dell Precision™ 650 Computer

**Dell Precision™ Workstation 650 and Dell Precision Workstation 450 Service Manual**



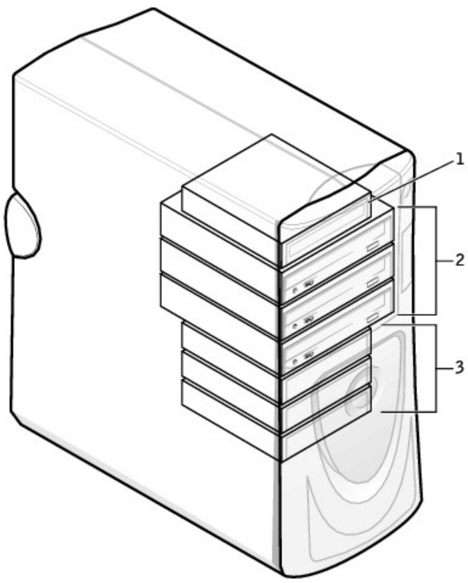
**CAUTION: Before you begin any of the procedures in this section, follow the safety instructions in the *System Information Guide*.**

---

## Overview

Your computer supports:

- Three hard drives
- One floppy drive
- Three CD or DVD drives




| | |
|---|---|
| 1 | floppy drive(s) |
| 2 | CD/DVD drive(s) |
| 3 | hard drive(s) |

### IDE Drive Addressing

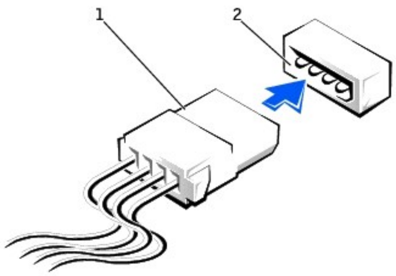
When you connect two IDE devices to a single IDE interface cable and configure them for the cable select setting, the device attached to the last connector on the interface cable is the primary (master) or boot device (drive 0), and the device attached to the middle connector on the interface cable is the secondary (slave) device (drive 1). See the drive documentation in your upgrade kit for information on configuring devices for the cable select setting.

Since cable select is the default setting, any additional drives that are installed do not need to be set as a primary or secondary drive.

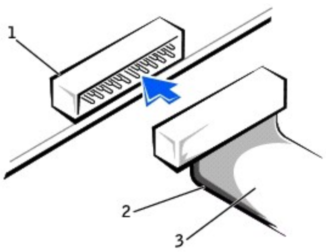
Your computer supports up to two IDE devices. Hard drives should be connected to the connector labeled "IDE1," and CD/DVD drives should be connected to the connector labeled "IDE2."

### Connecting Drive Cables

When you install a drive, you connect two cables—a DC power cable and an interface cable—to the back of the drive.




| | |
|---|---|
| 1 | power cable |
| 2 | power input connector |




| | |
|---|---|
| 1 | interface connector |
| 2 | colored stripe on cable |
| 3 | interface cable |

Most interface connectors are keyed for correct insertion; that is, a notch or a missing pin on one connector matches a tab or a filled-in hole on the other connector. Keyed connectors ensure that the pin-1 wire in the cable (indicated by the colored stripe along one edge of the cable) goes to the pin-1 end of the connector. The pin-1 end of a connector on a board or a card is usually indicated by a silk-screened "1" printed directly on the board or card.

**NOTICE:** When you connect an interface cable, do not place the colored stripe away from pin 1 of the connector. Reversing the cable prevents the drive from operating and could damage the controller, the drive, or both.

## SCSI Device Installation Guidelines

This section describes how to configure and install SCSI devices in your computer. To install a SCSI device, you can use one or both of the following SCSI controllers:

- The SCSI connector on the system board. To locate the SCSI system board connector, see the system board illustration, see "System Board Components" ) or the interior service label.

**NOTE:** The system board SCSI controller supports hard drives only. Do not connect CD or DVD drives, tape drives, DAT drives, and so on.

- A SCSI controller card installed in your computer.

## SCSI ID Numbers

Internal SCSI devices must have a unique SCSI ID number from 0 to 15. If you are using the SCSI connector on the system board and a SCSI controller card installed in your computer, you have two separate SCSI buses operating. Each SCSI bus has a set of SCSI ID numbers from 0 to 15.

When SCSI devices are shipped from the factory, the default SCSI ID numbers are assigned as follows:

| **System Board Controller** | | **Controller Card** | |
|---|---|---|---|
| **Device** | **ID** | **Device** | **ID** |
| Controller | 7 | Controller | 7 |
| Boot hard drive | 0 | Boot hard drive | 0 |
| | | CD or DVD drive | 5 |
| | | tape or DAT drive | 6 |
| **NOTE:** There is no requirement that SCSI ID numbers be assigned sequentially or that devices be attached to the cable in order by ID number. If two or more devices use the same ID, your computer may hang during POST and in SCSI BIOS. | | | |

SCSI devices installed by Dell are configured correctly during the manufacturing process. You do not need to set the SCSI ID for these SCSI devices.

If you attach additional optional SCSI devices, see the documentation for each device for information about setting the appropriate SCSI ID number.

**NOTICE:** Dell recommends that you use only SCSI cables purchased from Dell. Cables purchased elsewhere are not guaranteed to work with Dell computers.

### Device Termination

SCSI logic requires that termination be enabled for the two devices at opposite ends of the SCSI chain and disabled for all devices in between.

It is recommended that you use terminated cables and that you disable termination on all devices. See the documentation provided with any optional SCSI device you purchase for information on disabling termination on the device.

### General Guidelines

Follow these general guidelines when installing SCSI devices in your computer:

- Although you install SCSI devices essentially the same way as other devices, their configuration requirements are different. For details on configuring your particular SCSI subsystem, see the documentation for your SCSI devices and/or your host adapter card.
- Configure the device for a SCSI ID number and disable termination, if necessary.
- To use an external SCSI device, you must have a SCSI controller card installed in your computer. Connect one end of the external SCSI cable to the connector on the back of the SCSI device. Attach the other end of the external SCSI cable to the connector on the controller card installed in the computer.
- After you install a SCSI hard drive, **Primary Drive 0** and **Primary Drive 1** should be set to **None** in system setup if no IDE hard drives are installed. If you have any EIDE devices on the second IDE channel, such as a CD or tape drive, **Secondary Drive 0** and/or **Secondary Drive 1** should be set to **Auto**.
- You may need to use programs other than those provided with the operating system to partition and format SCSI hard drives. See the documentation that came with your SCSI software drivers for information on installing the appropriate drivers and preparing your SCSI hard drive for use.

### SCSI Cables

Ultra 320, Ultra 160/m, and Ultra2/Wide LVD drives (typically hard drives) both use a 68-pin cable. One end of the cable attaches to the SCSI connector on the system board or the SCSI controller card installed in your computer. The remaining connectors on the cable attach to the various drives.

Narrow SCSI drives (tape drives, CD drives, and some hard drives) use a 50-pin cable. One end of this cable attaches to the SCSI controller card. The remaining connectors on the cable attach to the various Narrow SCSI devices.

**NOTICE:** Dell recommends that you use only SCSI cables purchased from Dell. Cables purchased elsewhere are not guaranteed to work with Dell computers.

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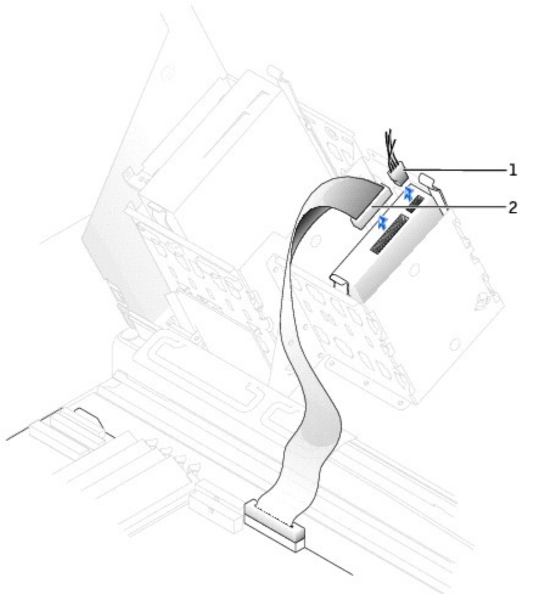
## Hard Drive

**CAUTION: Before you begin any of the procedures in this section, follow the safety instructions in the *System Information Guide*.**

**NOTICE:** To avoid damage to the drive, do not set it on a hard surface. Instead, set the drive on a surface, such as a foam pad, that will sufficiently cushion it.

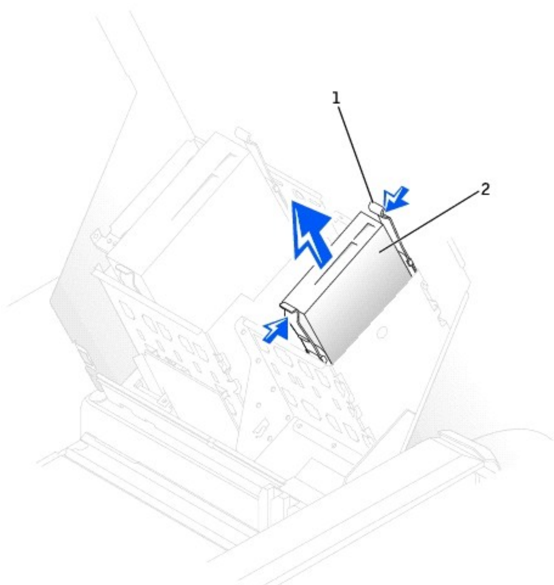
### Removing a Hard Drive

1. If you are replacing a hard drive that contains data you want to keep, back up your files before you begin this procedure.
2. Disconnect the power and hard-drive cables from the drive.




| | |
|---|---|
| 1 | power cable |
| 2 | hard-drive cable |

3. Press in on the tabs on each side of the drive and slide the drive up and out.



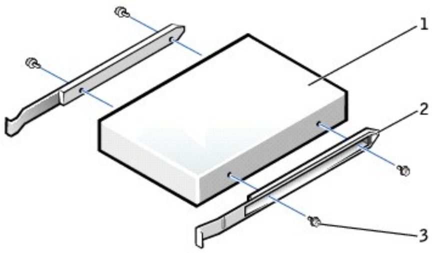

| | |
|---|---|
| 1 | tabs (2) |
| 2 | hard drive |

## Installing a Hard Drive

1. Unpack the replacement hard drive, and prepare it for installation.

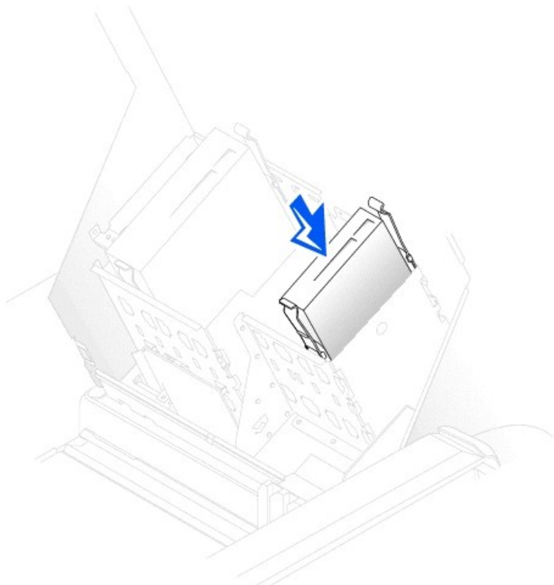
2. Check the documentation for the drive to verify that it is configured for your computer.

3. If your replacement hard drive does not have the bracket rails attached, remove the rails from the old drive by removing the two screws that secure each rail to the drive. Attach the bracket rails to the new drive by aligning the screw holes on the drive with the screw holes on the bracket rails and then inserting and tightening all four screws (two screws on each rail).




| | |
|---|---|
| 1 | drive |
| 2 | bracket rails (2) |
| 3 | screws (4) |

4. Gently slide the drive into place until the tabs securely click into position.

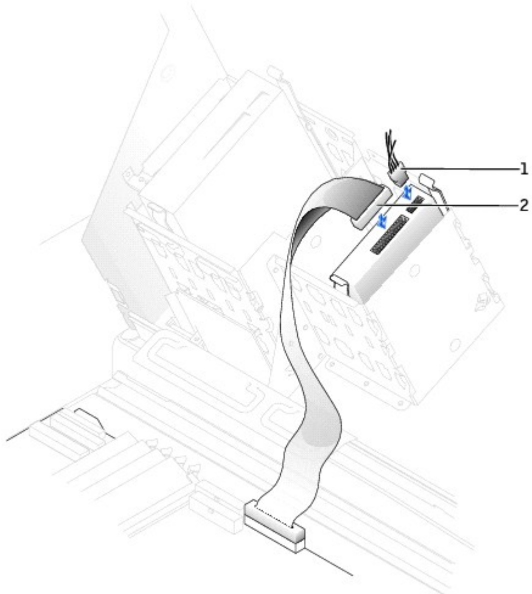


5. If you are installing a drive that has its own controller card, install the controller card in an expansion slot.

   See the documentation that accompanied the drive and controller card to verify that the configuration is correct for your computer.

**NOTICE:** Match the colored strip on the cable with pin 1 on the drive (pin 1 is marked as "1").

6. Connect the power and hard-drive cables to the drive.




| | |
|---|---|
| 1 | power cable |
| 2 | hard-drive cable |

7. Check all connectors to be certain that they are properly cabled and firmly seated.
8. Close the computer cover.

**NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

9. Connect your computer and devices to electrical outlets, and turn them on.

   See the documentation that came with the drive for instructions on installing any software required for drive operation.

10. If the drive you just installed is the primary drive, insert a bootable floppy disk into drive A.
11. Turn on the computer.
12. Enter system setup, and update the your drive configuration.
13. After you have updated the system settings, exit system setup, and restart the computer.
14. Partition and logically format your drive before you proceed to the next step.

    See the documentation for your operating system for instructions.

15. Test the hard drive by running the Dell Diagnostics.
16. If the drive you just installed is the primary drive, install your operating system on the hard drive.

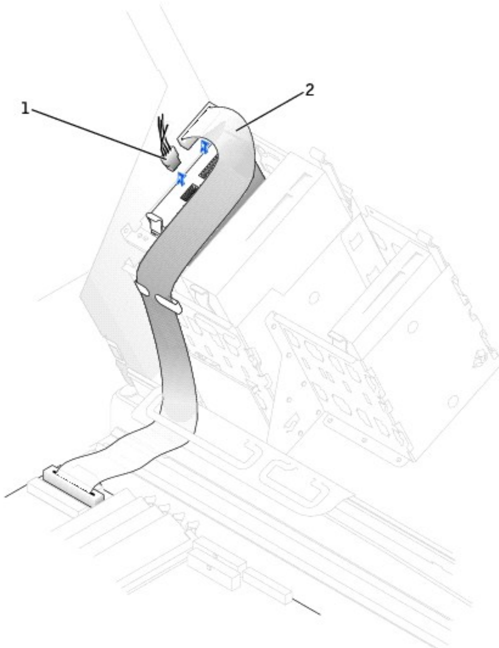
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## Floppy Drive

**CAUTION: Before you begin any of the procedures in this section, follow the safety instructions in the *System Information Guide*.**

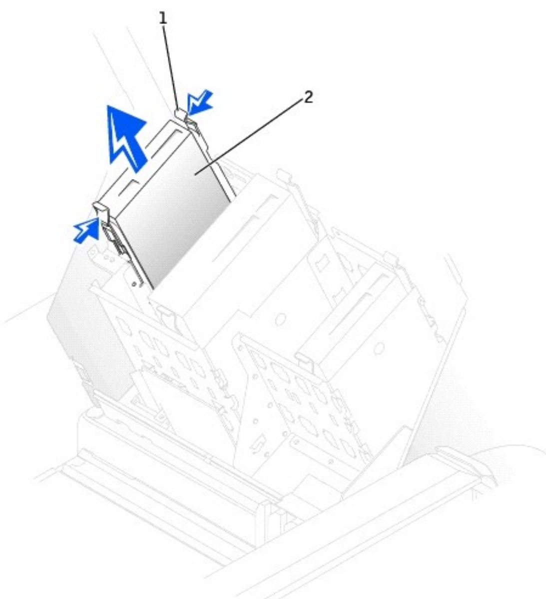
### Removing a Floppy Drive

1. Disconnect the power and floppy-drive cables from the back of the floppy drive.




| | |
|---|---|
| 1 | power cable |
| 2 | floppy-drive cable |

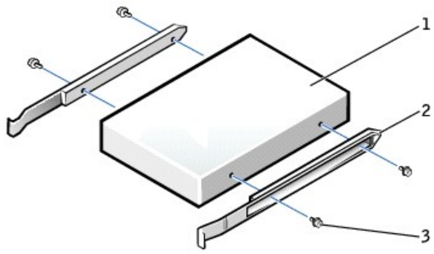
2. Press inward on the two tabs on the sides of the drive, slide the drive upward, and remove it from the floppy-drive bay.




| | |
|---|---|
| 1 | tab (2) |
| 2 | floppy drive |

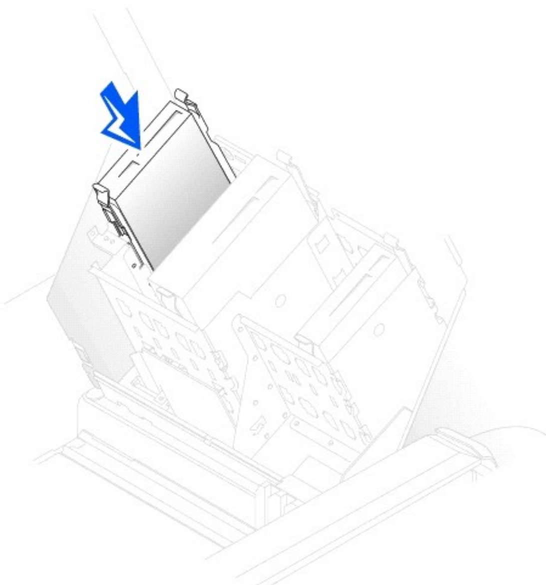
## Installing a Floppy Drive

1. If you are replacing a drive and the the new drive does not have the bracket rails attached, remove the rails from the old drive by removing the two screws that secure each rail to the drive. Attach the bracket to the new drive by aligning the screw holes on the drive with the screw holes on the bracket rails and then inserting and tightening all four screws (two screws on each rail).

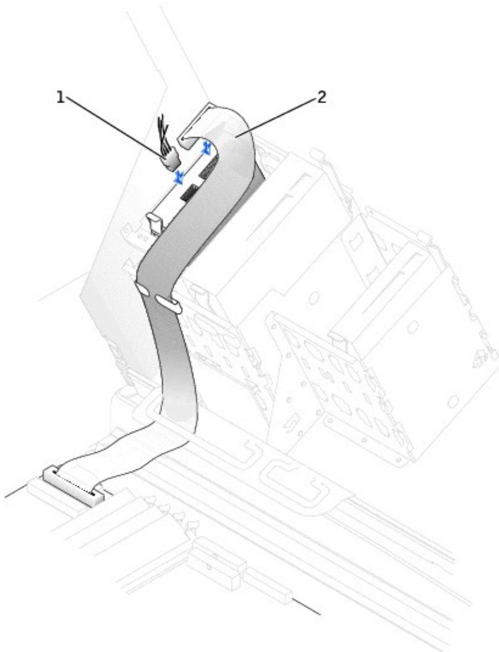



| | |
|---|---|
| 1 | drive |
| 2 | bracket rails (2) |
| 3 | screws (4) |

2. Gently slide the drive into place until the tabs securely click into position.



3. Attach the power and floppy-drive cables to the floppy drive.




| | |
|---|---|
| 1 | power cable |
| 2 | floppy-drive cable |

4. If you are installing a new floppy drive rather than replacing a drive, remove the front-panel inserts.

   From inside the drive bay, gently press on each side of the insert until it pops out.

5. Check all cable connections, and fold cables out of the way to provide airflow for the fan and cooling vents.
6. Close the computer cover.

**NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

7. Connect your computer and devices to electrical outlets, and turn them on.

   See the documentation that came with the drive for instructions on installing any software required for drive operation.

8. Enter system setup and update the appropriate **Diskette Drive A** option to reflect the size and capacity of your new floppy drive.
9. To verify that your computer works correctly, run the Dell Diagnostics.

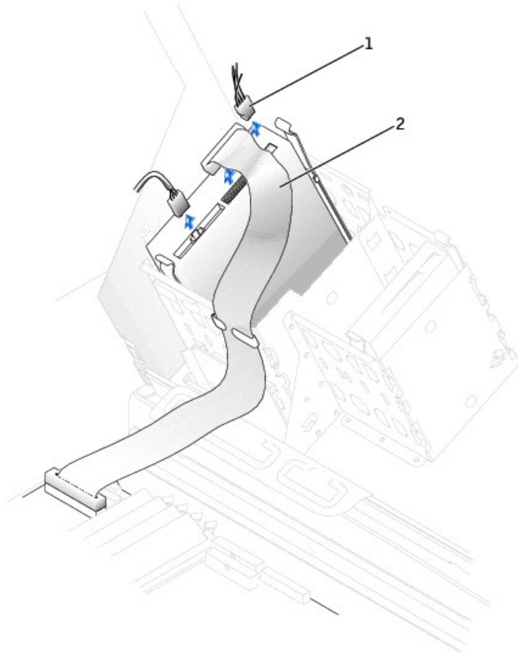
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## CD/DVD Drive

**CAUTION: Before you begin any of the procedures in this section, follow the safety instructions in the *System Information Guide*.**

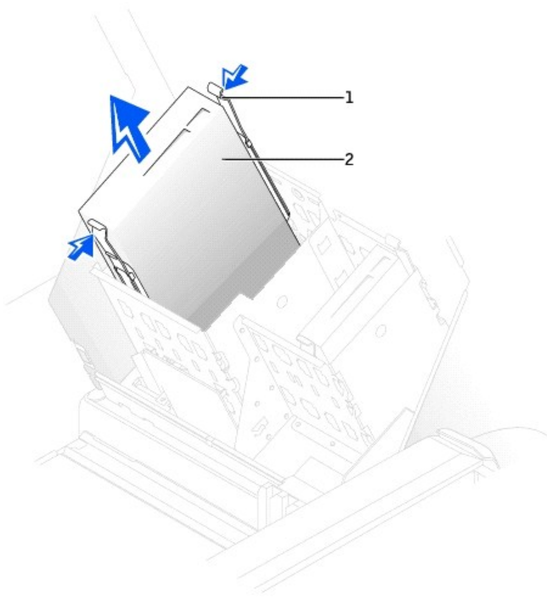
### Removing a CD/DVD Drive

1. Disconnect the power and CD/DVD drive cables from the back of the drive.




| | |
|---|---|
| 1 | power cable |
| 2 | CD/DVD drive cable |

2. Press inward on the two tabs on the sides of the drive, and then slide the drive upward and remove it from the drive bay.




| | |
|---|---|
| 1 | tab (2) |
| 2 | CD/DVD drive |

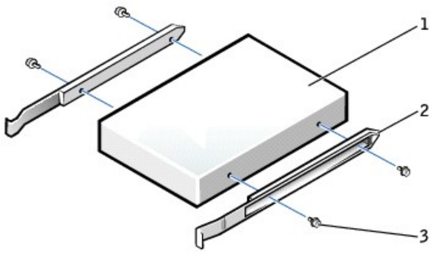
## Installing a CD/DVD Drive

1. If you are installing a new drive, unpack the drive and prepare it for installation.

   Check the documentation that accompanied the drive to verify that the drive is configured for your computer. If you are installing an IDE drive, configure the drive for the cable select setting.

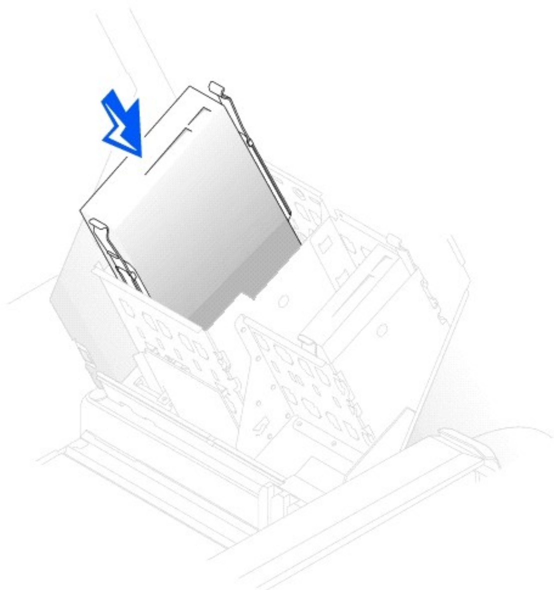
2. Connect the new drive to the set of rails that are attached to the inside of the cover. If a set of rails is not attached inside the computer cover, contact Dell.

3. If you are installing a replacement drive and the new drive does not have the bracket rails attached, remove the rails from the old drive by removing the two screws that secure each rail to the drive. Attach the bracket to the new drive by aligning the screw holes on the drive with the screw holes on the bracket rails and then inserting and tightening all four screws (two screws on each rail).




| | |
|---|---|
| 1 | drive |
| 2 | bracket rails (2) |
| 3 | screws (4) |

4. Gently slide the drive into place until the tabs securely click into position.

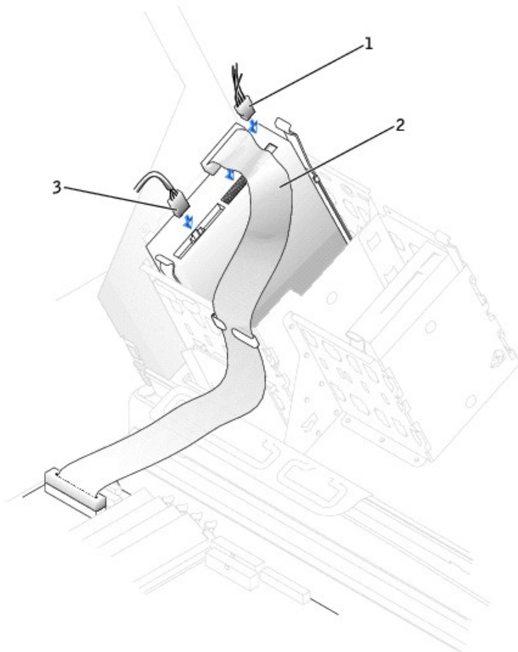


5. If you are installing a drive that has its own controller card, install the controller card in an expansion slot.

   See the documentation that accompanied the drive and controller card to verify that the configuration is correct for your computer.

6. Connect the power and CD/DVD drive cables to the drive.

   If you are adding a drive that has an audio cable, connect the audio cable to the audio connector on the system board.




| | | |
|---|---|---|
| 1 | power cable | |
| 2 | audio cable (some drives do not have this cable) | |
| 3 | CD/DVD drive cable | |

7. If you are installing a new CD/DVD drive rather than replacing a drive, remove the front-panel inserts.

   From inside the drive bay, gently press on each side of the insert until it pops out.

8. Check all cable connections, and fold cables out of the way to provide airflow for the fan and cooling vents.
9. Close the computer cover.

**NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

10. Connect your computer and devices to electrical outlets, and turn them on.

    See the documentation that came with the drive for instructions on installing any software required for drive operation.

11. Update your configuration information by setting the appropriate **Drive** option (**0 or 1**) under **Drives**: **Secondary** to **Auto**. See "Advanced Features" in your *User's Guide* for more information.
12. Verify that your computer works correctly by running the Dell Diagnostics.

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# VRM

**Dell Precision™ Workstation 650 and Dell Precision Workstation 450 Service Manual**



**CAUTION: Before you begin any of the procedures in this section, follow the safety instructions in the *System Information Guide*.**

**NOTICE:** A VRM must be installed to operate dual microprocessors. To locate the VRM connector, see either the system board components illustration (for the Dell Precision 650 computer, see "System Board Components" or for the Dell Precision 450 computer, see "System Board Components") or the system board label inside your computer.

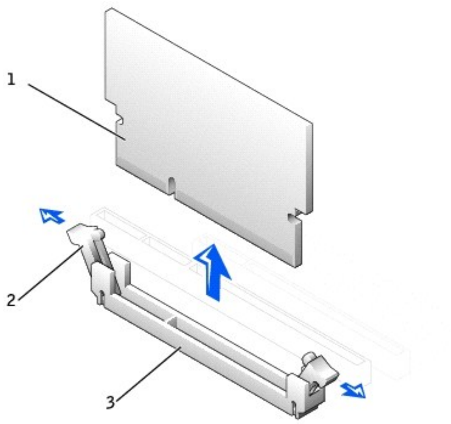
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## Installing a VRM

1. Remove the microprocessor airflow shroud (for the Dell Precision 650 computer, see "Microprocessor Airflow Shroud — Dell Precision™ 650 Computer" or for the Dell Precision 450 computer, see "Microprocessor Airflow Shroud — Dell Precision™ 450 Computer").

2. Press the securing clips at each end of the VRM connector outward until they snap open.

   To locate the VRM connector, see the system board components illustration (for the Dell Precision 650 computer, see "System Board Components" or for the Dell Precision 450 computer, see "System Board Components") or see the system board label inside your computer.




| | |
|---|---|
| 1 | VRM |
| 2 | securing clips (2) |
| 3 | connector |

3. Align the notch on the bottom of the VRM with the ridges inside the connector.

4. Press the VRM straight down into the connector until the securing clips snap into place at the ends of the module.

5. Install the microprocessor airflow shroud (for the Dell Precision 650 computer, see "Microprocessor Airflow Shroud — Dell Precision™ 650 Computer" or for the Dell Precision 450 computer, see "Microprocessor Airflow Shroud — Dell Precision™ 450 Computer").

6. Close the computer cover.

**NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

7. Connect your computer and devices to electrical outlets, and turn them on.

---

## Removing a VRM

1. Remove the microprocessor airflow shroud (for the Dell Precision 650 computer, see "Microprocessor Airflow Shroud — Dell Precision™ 650 Computer" or for the Dell Precision 450 computer, see "Microprocessor Airflow Shroud — Dell Precision™ 450 Computer").

2. Press the securing clips at each end of the connector outward simultaneously until the VRM slightly pops out from the connector.

3. Grasp the VRM by its top corners, and ease it out of the connector.

4. If you are installing a new VRM, see "Installing a VRM."

   If you are not installing a new VRM, continue with step 5.

5. Install the microprocessor airflow shroud (for the Dell Precision 650 computer, see "Microprocessor Airflow Shroud — Dell Precision™ 650 Computer" or

for the Dell Precision 450 computer, see "Microprocessor Airflow Shroud — Dell Precision™ 450 Computer").

6. Close the computer cover.

**NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

7. Connect your computer and devices to electrical outlets, and turn them on.

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# Memory

**Dell Precision™ Workstation 650 and Dell Precision Workstation 450 Service Manual**



**CAUTION: Before you begin any of the procedures in this section, follow the safety instructions in the *System Information Guide*.**

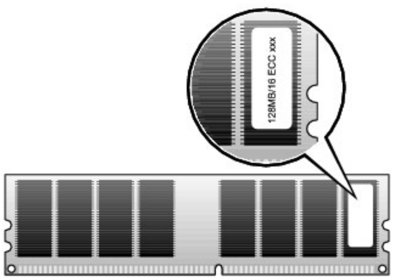
You can increase your computer memory by installing memory modules on the system board. For information on the type of memory supported by your computer, see "Specifications" in your *User's Guide*.

---

## Memory Installation Guidelines

- Memory module connectors must be upgraded in matched pairs. Memory module connectors 1 and 2 must contain modules of identical size, type, speed, and number of chips and memory module connectors 3 and 4 must contain modules of identical size, type, speed, and number of chips. To locate the memory sockets on the system board, see the system board components illustration (for the Dell Precision 450 computer, see "System Board Components" or for the Dell Precision 650 computer, see "System Board Components") or the system board label inside your computer.
- Before you install new memory modules, download the most recent BIOS for your computer from the Dell Support website at **support.dell.com.**

**Memory Module Label**




### Addressing Memory With 4-GB Configurations

Your computer supports a maximum of 4GB of memory when using four 1-GB DIMMs. Current operating systems, such as Microsoft® Windows® 2000 and Windows XP, can only utilize a maximum of 4 GB of address space; however, the amount of memory available to the operating system is slightly less than 4 GB. Certain components within the computer require address space in the 4-GB range. Any address space reserved for these components cannot be used by computer memory. The following is a list of components that require memory address space:

- System ROM
- APIC(s)
- Integrated PCI devices, such as network connector, SCSI controller, and IEEE 1394 controller
- PCI and AGP cards
- The AGP Aperture size specified in system setup

At start-up the BIOS identifies the components that require address space. The BIOS dynamically calculates the amount of reserved address space required. It then subtracts the reserved address space from 4 GB to determine the amount of usable space.

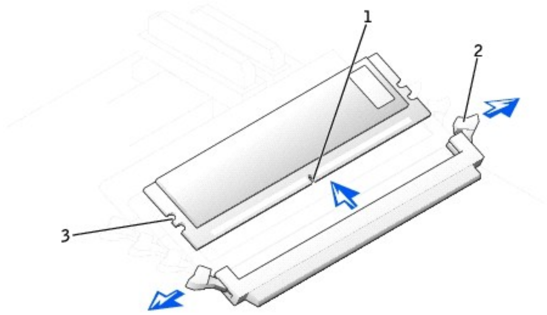
- If the total installed computer memory is less than the usable space, all installed computer memory is available for use only by the operating system.
- If the total installed computer memory is equal to or greater than the usable address space, a small portion of installed memory is available for use by the operating system.

---

## Removing a Memory Module

1. Press down and outward on the securing clips.
2. Grasp the module and pull up.

   If the module is difficult to remove, gently ease the module back and forth to remove it from the connector.

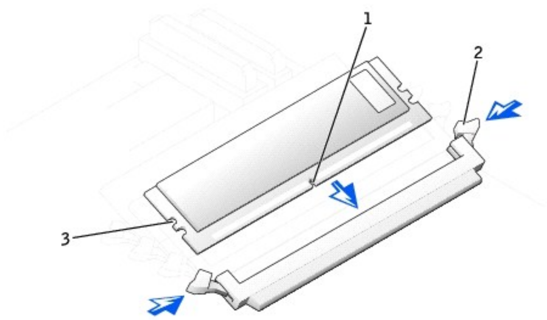



| | |
|---|---|
| 1 | notch |
| 2 | memory module securing clips (2) |
| 3 | alignment keys |

## Adding a Memory Module

1. Press out the securing clip at each end of the memory module connector.
2. Align the notch on the bottom of the module with the crossbar in the connector.
3. Insert the module into the connector, ensuring that it fits into the guides at each end of the connector. Carefully press each end of the module into place.

   The memory module socket has alignment keys that allow the memory module to be installed in the socket only one way.




| | |
|---|---|
| 1 | notch |
| 2 | memory module securing clips (2) |
| 3 | alignment keys |

4. Pull up on the securing clips to lock the modules into place.

   If you insert the module correctly, the securing clips snap into the cutouts at each end of the module.

   When the memory module is properly seated in the socket, the securing clips on the memory module socket should align with the securing clips on the other sockets with memory modules installed.

5. Close the computer cover.

**NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

6. Connect your computer and devices to electrical outlets, and turn them on.

   The computer detects that the new memory does not match the existing configuration information and generates the following message:

```
The amount of system memory has changed.
Strike the F1 key to continue, F2 to run the setup utility
```

7. Press <F2> to enter system setup and check the value for **System Memory**.

   The computer should have changed the value of **System Memory** to reflect the newly installed memory. Verify the new total. If it is correct, skip to step 10.

8. If the memory total is incorrect, turn off and disconnect your computer and devices from electrical outlets.

9. Open the computer cover and check the installed memory modules to ensure that they are seated properly in their sockets. Then repeat steps step 4 through step 7.

10. When the **System Memory** total is correct, press <Esc> to exit system setup.

11. Run the Dell Diagnostics to verify that the memory modules are operating properly.

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# Microprocessor Airflow Shroud — Dell Precision™ 650 Computer

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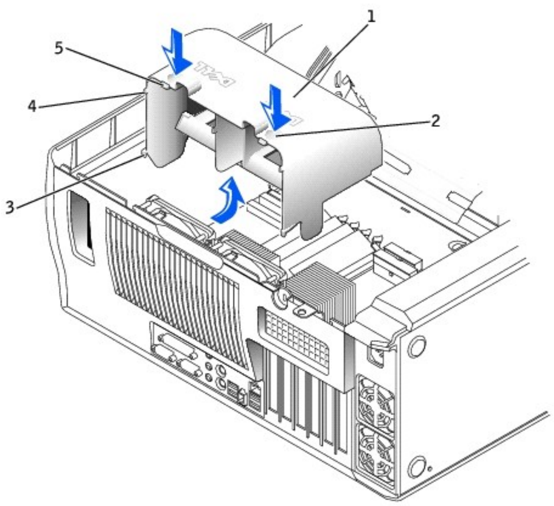
**CAUTION: Before you begin any of the procedures in this section, follow the safety instructions in the *System Information Guide*.**

## Removing the Microprocessor Airflow Shroud

1. Press down and back on the indentations at the top corners of the shroud.

   The top anchor tabs disengage from the anchor slots.

2. Lift the airflow shroud out of the computer.




| | |
|---|---|
| 1 | airflow shroud |
| 2 | indentations (2) |
| 3 | bottom anchor tabs (2) |
| 4 | side anchor tabs (2) |
| 5 | top anchor tabs (2) |

## Installing the Microprocessor Airflow Shroud

1. Insert the bottom anchor tabs into the anchor slots.
2. Align and insert the side anchor tabs into the anchor slots.
3. Press the indentations until the top anchor tabs on the shroud snap securely into place.
4. Close the computer cover.

**NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

5. Connect your computer and devices to electrical outlets, and turn them on.

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# Power Supply — Dell Precision™ 650 Computer

**Dell Precision™ Workstation 650 and Dell Precision Workstation 450 Service Manual**

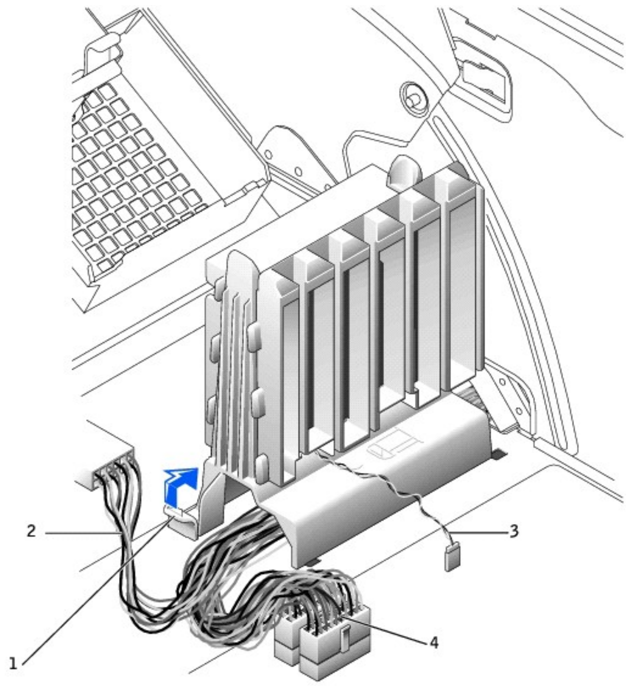


**CAUTION: Before you begin any of the procedures in this section, follow the safety instructions in the *System Information Guide*.**

## Removing the Power Supply

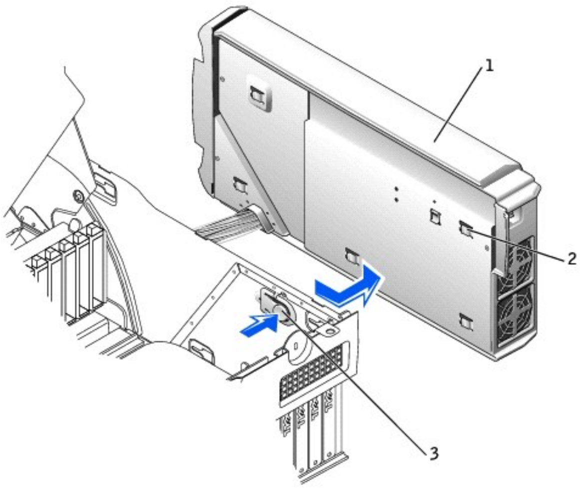
**NOTICE:** Before disconnecting a device from the computer, wait 10 to 20 seconds after disconnecting the computer from its electrical outlet. Before removing a component from the system board, verify that the standby power light on the system board has turned off. To locate this light, see "System Board Components."

1. Remove the cards and the card fan.
2. Disconnect the power supply cables and the card fan cable.




| | |
|---|---|
| 1 | fan-guide release button |
| 2 | drive power cable |
| 3 | card fan cable |
| 4 | power supply cables |

3. Remove the card fan guide:
   a. Pull up on the fan-guide release button.
   b. Slide the card fan guide to the right.
   c. Lift the card fan guide out of the four securing slots in the computer.
4. While pressing the power-supply release button, slide the power supply toward the back of the computer.




| | |
|---|---|
| 1 | power supply |
| 2 | power-supply securing tab (5) |
| 3 | power-supply release button |

5. Lift the power supply away from the computer.
6. Slide the power supply cables out of the computer (through the hole).

---

## Replacing the Power Supply

1. Slide the power supply cables through the hole into the computer.
2. Insert the power-supply securing tabs into the power-supply securing slot on the computer, ensuring that each securing tab is connected to its slot on the computer.
3. Slide the power supply toward the front of the computer.
4. Install the card fan guide:
   a. Place the card fan guide into the four securing slots in the computer.
   b. Slide the card fan guide to the left until it locks into position.
5. Connect the power supply cables and the card fan cable.
6. Replace the card fan.
7. Install the cards.
8. Close the computer cover and restart the computer.

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# System Board

**Dell Precision™ Workstation 650 and Dell Precision Workstation 450 Service Manual**

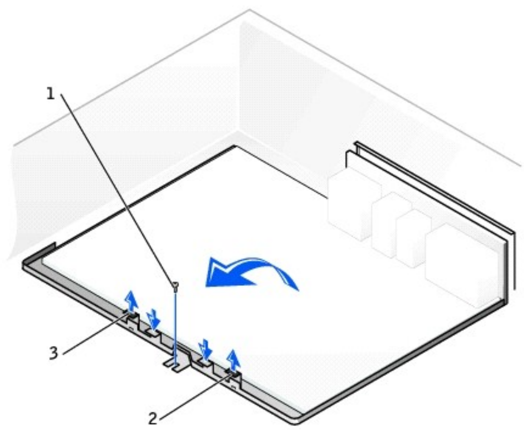


**CAUTION: Before you begin any of the procedures in this section, follow the safety instructions in the *System Information Guide*.**

**NOTICE:** The system board and metal tray are connected and are removed as one piece.

## Removing the System Board

1. Remove any components that restrict access to the system board.
2. Disconnect all cables from the system board.
3. Before you remove the existing system board assembly, visually compare the replacement system board to the existing system board to make sure that you have the correct part.
4. Remove the system board screw.




| | |
|---|---|
| 1 | system board screw |
| 2 | tab |
| 3 | tab |

5. Pull up on the two tabs, slide the system board assembly toward the front of the computer, and then lift the asembly up and away.
6. Place the system board assembly that you just removed next to the replacement system board.

## Replacing the System Board

1. Transfer components from the existing system board to the replacement system board:
   a. Remove the memory modules and install them on the replacement board.

**CAUTION: The microprocessor package and heat-sink assembly can get hot. To avoid burns, ensure that the package and assembly have had sufficient time to cool before you touch them.**

   b. Remove the heat-sink assembly and microprocessor from the existing system board and transfer them to the replacement system board.

2. Configure the settings of the replacement system board.
3. Set the jumpers on the replacement system board so they are identical to the ones on the existing board.

**NOTE:** Some components and connectors on the replacement system board may be in different locations than the corresponding connectors on the existing system board.

4. Orient the replacement board by aligning the notches on the bottom of the board with the tabs on the computer.

5. Slide the system board assembly toward the back of the computer until the assembly clicks into position.
6. Replace any components and cables that you removed from the system board.

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